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ABSTRACT

This booklet is a collection of energy activities to be infused into existing science and social studies courses at the seventh and ninth grade levels. The activities were written for students at different levels of problem solving ability, emphasizing the learning and use of knowledge about energy. By using energy knowledge in these problem-solving activities, students will be developing the thinking skills necessary in the adult world of real problems and critical issues. Activities are presented in seven sections: (1) finding energy information; (2) energy error cards which contain a brief energy situation that involves an error in understanding, belief, or reasoning; (3) critical thinking energy skills; (4) energy persuasion; (5) three energy decision-making cases; (6) solar energy activities (including simple plans for constructing three solar structures); and (7) touring a power plant. Instructional strategies are provided for either an entire section or specific activities within a section. (Author/JN)

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

NOTE TO TEACHERS:

You are encouraged to ditto and/or xerox the lessons/ activities in this booklet for use with your students. The lessons were written for students at different levels of problem solving ability. They were designed to be infused into existing science and social studies courses at the seventh and the ninth grade levels. Our emphasis is upon learning and using knowledge about energy. We are not promoting the rote memorization of information, concepts, or generalizations about energy issues and problems. By using their knowledge in these problem-solving lessons, students will be developing the THINKING SKILLS so necessary in the adult world of real problems and critical issues.

TEACHER/AUTHOR:

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This project was supported with a mini-grant from the Florida Office of Energy and Environmental Education, C. Richard Tillis, Director, and Paul Coley, Regional Coordinator. Materials were supplied by the Governor's Energy Office, Rosalyn B. Tillis, Education Coordinator.

In 1981, the Florida Office of Energy and Environmental Education, Tallahassee, funded a small project to assist science and social studies teachers in grades 7th and 9th to develop materials to teach about ENERGY and our ENERGY CRISIS Teachers had the opportunity to learn about current energy issues within an environmental context.....and then, prepare instructional activities stressing basic student reasoning. We hoped to assist students in becoming more responsible users of renewable and non-renewable energy resources.

Teachers of 7th and 9th grade social studies and science participated. Each teacher:

1) Studied new energy realities facing citizens and governments at the local, state, and national levels;

2) Reviewed many existing instructional units for energy education in science and social studies and;

3) Developed and tested at least three exemplary lessons/activities for use with students which stresses basic energy reasoning skills in science or social studies at the 7th or 9th grade level.

An Introductory session was held at Godby High School on Tuesday, August 25th, 1981, for 2 hours.

All-day sessions were held on:

a) Thursday, Friday, and Saturday, September 24th, 25th, and 26th, 1981; September 24th and 25th at Myers Park and September 26 at Teacher Education Center;

b) Friday, December 4th 1981, at the TALLAHASSEE JUNIOR MUSEUM; and

c) Thursday, January 20th, 1981, at the TALLAHASSEE JUNIOR MUSEUM

Talks were presented by energy specialists from a variety of areas, including:

Dr. David E. LaHart, PhD, Florida Solar Energy Center, Cape Canaveral;
C. Richard Tillis, Florida Office of Environmental/Energy Education;
Rod Allen, Florida State University;
Jim Phillips, Florida Office of Environmental/Energy Education; and
Local electric power generating officials.

PROJECT REEN sponsors included: The Leon County Schools; the Leon County teacher Education center; Paul Coley, Florida Office of Environmental/Energy Education; Florida State University; and Rosalyn B. Tillis, Governor's Energy Office.

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ENERSKILLS NAME_____

LOCATING INFORMATION: USING AN ATLAS

Go to your library and find the atlas. Then use the atlas to answer the following questions.

What is the name of your atlas?
Who published it?
When was it published?

1. Finding a place in the atlas is very similar to using the Index in a book. Some atlasses will use letters as guide numbers while others use letters and numbers, or only numbers as guides to finding a location. Turn to the Index to find the following places which are important in world energy trade:

	PAGE	GUIDE NUMBERS
Cape of Good Hope		
Persian Gulf		
Saudi Arabia		
Kwait		
Nigeria		
Angola		
Suez Canal		
Venezuela		
Mexico		
Louisiana		

2. What other information does the atlas which you are using give you about world energy resources and commerce in energy?

3. Use a recent newspaper to locate an article on energy resources. Find places mentioned and note the pages and guide numbers of these places in your atlas.

ENERSKILLS NAME_____

LOCATING INFORMATION: USING THE DICTIONARY

The dictionary is used to find the meanings of words, to find out how to spell and pronounce words, and to find out about the history of words Answer the following questions, using your dictionary.

1. Use each of the following words in a sentence:

   a) POWER
   b) ENERGY
   c) WORK
   d) ELECTRICITY
   e) WATT

2. Look up the meanings given for each word. Write out the meaning for each word which refects how you have used the word in your sentence.

3. Divide each word into syllables:

   a) POWER
   b) ENERGY
   c) WORK
   d) ELECTRICITY
   e) WATT

4. Write a sentence or two on the history of each word.

   a) POWER

   b) ENERGY

   c) WORK

   d) ELECTRICITY

   e) WATT

Write down the name of the dictionary you used:_____

USING THE YELLOW PAGES: LOCATING INFORMATION

Get a local telephone book and turn to the yellow pages. Use the yellow pages to respond to the following questions.

1. What are the yellow pages used for?

2. What information is presented in the yellow pages?

3. Why would the telephone company have a separate section called the "yellow pages"?

4. If you wanted to get a plumber to install a solar water heater, where would you look in the yellow pages? Give the names of two plumbers you might call to get such an installation.

5. If you wanted to purchase a solar water heater, where would you look for solar companies in your area? Give the name and phone number of one company which might to able to sell you a collector for your roof.

6. If you want to check the EER (Energy Efficiency Rating) of three refrigerators advertised in the newspaper, who would you call? Give the names, addresses, and telephone numbers of three companies in your area who sell refrigerators.

7. If you wanted to call an appliance store owner to check on the prices of fans and dehumidifiers, who might you call? Write down the name, address, and telephone number of the store closest to your school.

8. You want a ceiling fan for your den or living room. Use the yellow pages to located the store specializing in ceiling fans which is closest to your home. Write down the name, address, and telephone number for theat store.

ENERSKILLS NAME_____

LOCATING INFORMATION: USING THE TELEPHONE BOOK

1. Using the telephone book, how would you find the telephone number of the Florida Solar Energy Center, Cape Canaveral, FL?

   The number for the Florida Solar Energy Center is ( ) _____

2. Using the telephone book, how would you find the telephone number of your County Home Economics Extention Agents?

   The number is ( ) _____

3. Using your telephone directory, how would you find the number of the Governor's Energy Office, Tallahassee?

   The number is ( ) _____

4. Using your telephone directory, how would you find the number of the United States Department of Energy?

   The number is ( ) _____

5. You have purchased more insulation and a solar collector. You want to check on your income tax credit with the IRS (Internal Revenue Service, U.S. Government). How would you call them using the telephone directory to locate their number?

   The IRS number for your area is ( ) _____

6. You want to have your electric meter checked to see if your bill at home is accurate. Use the telephone book and write down the number for your local electric utility company ( ) _____.

7. You want to see is the local library has Dr. LaHart's lastest book on nuclear power. Use the telephone directory to get the name, address, and telephone number of your library ( ) _____

ENERSKILLS NAME_____

LOCATING INFORMATION: USING THE CARD CATALOGUE

Go to the card catalogue in your local library and find information on NUCLEAR ENERGY.

1. How many SUBJECT HEADINGS are there for this topic?

2. List three of them. _____

   _____

   _____

3. Are there any SEE ALSO CARDS included for this topic?

4. If yes, under what other SUBJECT HEADINGS would you look for information on this topic? _____

   _____

   _____

5. Look up the following topics and give the SUBJECT HEADINGS under which you could find hooks on them:

   a) NATURAL GAS

   b) CONSERVATION, ENERGY

   c) SHALE OIL

   d) WINDMILLS

   e) PIPELINES, PETROLEUM

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ENERSKILLS NAME_____

LOCATING INFORMATION: USING THE CARD CATALOGUE

Go to the card catalogue in your library and look up a book on SOLAR ENERGY. Then, answer the following questions.

1. Under what subject heading did you look?

2. How many books were there on this topic: 1-5_____ 6-10_____ 10-50_____ 50_____

3. Where there any SEE ALSO CARDS included in this topic?

   If the answer is YES, under what other subject headings could you find information on SOLAR ENERGY?

4. Pick out one of the books you have found on this topic and fill in the following information:

   Title of the book_____ Call Number_____

   Author_____

   Date Published_____

   Number of pages_____pages

ENERSKILLS NAME_____

LOCATING INFORMATION: READERS'GUIDE

Please study the sample Readers' Guide entry below. Then answer the following questions about the second sample entry.

Sample: CIVIL rights demonstrations
Day they didn't march.L. bennett. Jr. il Ebony 32:128-30+ F'77

Explanation An illustrated article on the subject "CIVIL rights demonstrations entitle "Day they did't march," by L. Bennett, Jr. will be found in volume 32 of Ebony magazine on pages 128-30 (continued on later pages of the same issue), February 1977.

Second Sample: NUCLEAR energy
No nuclear energy for us please; European letter to President Reagan, B. Tillis. Bull Atom Sci 38:7 D'81

What does this entry tell you?_____

_____

_____

_____

Activity: Go to the Readers' Guide and look up an entry on Solar Energy. Write down the entry and then tell what it means.

Entry _____

Meaning_____

_____

_____

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ENERSKILLS NAME_____

LOCATING INFORMATION: READERS' GUIDE

In the blank space before each of the following statements, write the word true if the statement is true. Write the word false, if the statement is not true.

_____ 1. The READERS' GUIDE is an up-to-date listing.

_____ 2. The READERS'GUIDE lists the subjects of magazine articles.

_____ 3. The READERS' GUIDE tells you the name of the magazine in which the article appeared.

_____ 4. The subjects in the READERS' GUIDE are in alphabetical order.

_____ 5. Not all magazines published have their articles listed in the READERS' GUIDE.

_____ 6. The READERS' GUIDE tells you the author of the article.

_____ 7. The READERS' GUIDE tells you the page numbers of the article.

_____ 8. The READERS' GUIDE tells you the title of the article.

_____ 9. The READERS' GUIDE tells you if the article has illustrations.

_____ 10. The READERS' GUIDE tells you if the article is hard or easy to read.

ENERSKILLS NAME_____

LOCATING INFORMATION: MAKING A GENERAL SEARCH

Go to your library an find a find a map, book, article, or encyclopedia entry on ENERGY CONSERVATION AT HOME.

1. Briefly tell HOW you completed this assignment.

2. I had trouble with this search and had to ask the librarian for help. The librarian suggested that I ...

3. I have the following questions about finding books, maps, articles, etc. in the library...

ENERGY ERROR CARDS

Most teachers attempt to present their subject in ways that are meaningful and relevant to their students' lives, and select course content that will help students make sense of what is happening around them. At the same time, most teachers are dedicated to developing their students' critical thinking skills. We have found an easy way of combining relevant content and critical thinking skills by using energy error cards. On each card is written a brief description of a realistic situation in which a person has argued about or acted upon an energy matter in a way that involves an error in understanding, belief, or reasoning. In this article we present situations for classroom use. The teacher could give the students a card with the energy error situation and, in some cases, a chart, map, table or graph pertaining to the situation. Students should be told that an error may have been made and that they must discover it. We developed the samples included herein for use with secondary school students.

ENERGY ERRORS: PRACTICAL, DAILY LIVING ENERGY ERRORS

Teachers should obtain a class set of TIPS FOR ENERGY SAVERS to accompany this lesson. Copies may be obtained from Rosalyn B. Tillis, Governor's Energy Office, 301 Bryant Bldg., Tallahssee, FL 32301

ENERGY ERROR: Dick Jones noticed that his home was constructed without insulation in the attic. He went to the lumber yard and purchased enough insulation to install three inches in the attic, just above the ceiling. Did he make an Energy Error?

ENERGY ERROR: Mary Jones had a beautiful fireplace in her Tallahassee home. Often during the winter, she built a fire in the fireplace to aid her furnace in heating the house. Did Mary make an Energy Error?

ENERGY ERROR: Sue Jones also had a beautiful fireplace in her living room. It was always ready to have a fire built in it. She did not ever close the damper. Did Sue make an Energy Error?

ENERGY ERROR: John Jones really liked air conditioning on warm summer days in Tallahassee. He kept his thermostat set on 75°F during the summer. Did John make an Energy Error?

ENERGY ERROR: Frances Jones was a busy, busy person. She knew that the hot water faucet in the bathroom was leaking, but she wanted at least two to leak before calling the plumber. Frances wanted to save dollars. Did Frances make an Energy Error?

ENERGY ERROR: Daphne Jones purchased a new water heater and the local store had it installed in her home. She never checked out the temperature on this electric heater, but noticed that the water was plenty hot. Did Daphne make an Energy Error?

ENERGY ERROR: Carol Jones purchased a new gas stove for the house. To save money, she got one with pilot lights rather than electric, automatic ignition. Did Carol make an Energy Error?

ENERGY ERROR: Rod Jones was a free living bachelor. When cooking or heating water he never used lids on his pans. That saved him from having to wash more dishes! Did Rod make an Energy Error?

ENERGY ERROR: Tracy Jones had a beautiful, remodeled bathroom in her home. She loved taking baths in it. The shower was rarely used. Did Tracy make an Energy Error?

ENERGY ERROR: Shirley Jones loves toasted bread with her breakfast each morning. To save money she did not buy a toaster, but toasts her bread in the oven. She saved $15.00! Did Shirley make an Energy Error?

ENERGY ERROR: Anita Jones bought a nice, shinny frost-free refrigerator. She loves it and the neat ice-maker! Did Anita make an Energy Error?

ENERGY ERROR: Tom Jones put a new roof on his home. To match the color scheme, he chose a black roof in sunny Tallahassee. Did Tom make an Energy Error?

ENERGY ERROR: To save money, Charles Jones cut back on the insulation in his new home. He put little in the walls and in the crawl-space. He did put five inches of fibreglas insulation in the attic. Did Charles make an Energy Error?

ENERGY ERROR: Bill Jones' new home faces to the south. He planted beautiful magnolia trees and pine trees on the south side and on the west side of his home. Did Bill make an Energy Error?

ENERGY ERROR: Benjamin Jones always drives fast. He never obeys the 55 MPH speed limit and never gets caught! He arrives where he is going faster than others. But, has Benjamin made an Energy Error?

ENERGY ERROR: Alice Jones always picks up her car pool at the corner of 5th and Wesson. Usually, Sally is late, but Alice and the others wait for the three to five minutes it takes for Sally to arrive! Alice often leaves the car motor running to save on the battery. Does Alice make an Energy Error?

ENERGY ERROR: Sally Jones bought new tires. To save a few dollars, she got bias-ply rather than radial tires for her van. Did Sally make an Energy Error?

ENERGY ERROR: Jack Jones jumped into the car and rushed off to the store across town to see if they still had the sale on cassette tapes. Unfortunately, when he got there, he learned that the sale ended last Tuesday. Did Jack make an Energy Error?

ENERGY ERROR: Carlos Jones bought a beautiful electric carving knife for his mother's birthday. Did he make an Energy Error?

ENERGY ERRORS: ENERGY CONSERVATION AT SCHOOL

Teachers using these Energy Error situations should obtain a school energy plan booklet from Rosalyn B. Tillis, Governor's Energy Office, 301 Bryant Bldg., Tallahassee, FL 32301. The Governor's Energy Office will soon publish a free School Energy Management Guidebooklet which Ms Tillis or Mr. Tom Barnum can provide.

ENERGY ERROR: During the heating or the cooling season, school doors are often left open. Students or teachers leave the building, carrying items, and the door does not get closed behind them. Have these "door-left-open-people" made an Energy Error?

ENERGY ERROR: On July 15th, 1981, a five foot by ten foot window at Fairview Middle School was shattered. As of September 26th, 1981, the window had not been replaced. School maintenance people proped a piece of plywood over a portion of the open space. But not all of the window area was covered. Several calls were made to the County School Office to get a replacement window....but without success. Since this school is air conditioned, have school leaders made an Energy Error?

ENERGY ERROR: In an effort to improve classroom lighting and to save energy, the School Board changed lighting in a middle school. The old incandescent lights were removed. Two banks of eight fixtures each of fluorescent lights were installed. The wattage of the old lights and the new lights are nearly the same. However, students and teachers feel that the new lights are very bright. A local energy auditor agrees. He said, "The rooms have far too much candlepower of light than is needed or required." Have school leaders made an Energy Error?

ENERGY ERROR: When a school board contracted to build a new middle school, they accepted the low bid on air conditioning units to be placed on the roof. The low bid certainly saved the school system money in the initial purchase. Unfortunately, these units did not work well so the repair costs were high. What Energy Error did school leaders make?

ENERGY ERROR: A local high school finally got its wish! Nice blue carpeting was installed in classrooms. Noise levels in classes went down. Pride went up. Unfortunately, no one thought to save money to purchase a vacuum cleaner. Has an ENERGY ERROR been made?

ENERGY ERROR: In an effort to make all schools in the district equal and comfortable for students, the School Board is going to air condition all schools without air conditioning. Many of these buildings were constructed years ago. They are not well insulated. They have high ceilings and many windows, which served well when natural air currents cooled the rooms.

Students and teachers are joyful about air conditioning. Some taxpayers have complained about the cost of air conditioning and the sharp increase in taxes.

Has the School Board made an ENERGY ERROR?

ENERGY ERROR: Years ago when Room 301 was a photography lab, the school leaders had a hot water heater installed there. Now Room 301 is a cluttered storage area, but the hot water heater still functions and keeps 20 gallons of water at 130° F. Might this be an ENERGY ERROR.

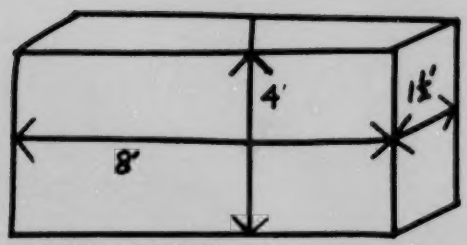
ENERGY ERROR: People in our town think that modern schools are wonderful! The buildings shine in their freshness. However, there are few windows which open on warm days. All air circulation is controlled by air conditioning units constructed by low-bidders. These conditioners must be operated each day school is in session. Did the school board make an ENERGY ERROR?

ENERGY ERROR: To save electricity, the school board has made new policies. Schools will be closed to afterschool use by community groups. The gum, cafeteria, and pool, which had been used by community groups, now cannot be used and they will have to go else where. The school board will save energy costs, but have they also made an ENERGY ERROR?

ENERGY ERROR: Students in Mr. Walker's science lab do not often use hot water. But when they do, it takes a long time to get <u>hot</u> water from the faucet. The water heater is in the gym which is 100 yards from the science lab. Did the school system make an ENERGY ERROR?

ENERGY ERROR: To save gasoline, the school board has severly limited field trips. Before the science classes went to the coast to study marine life. The social studies classes went to the Capital to study government in action. And elementary classes went to the Junior Museum. Has the school board made an ENERGY ERROR?

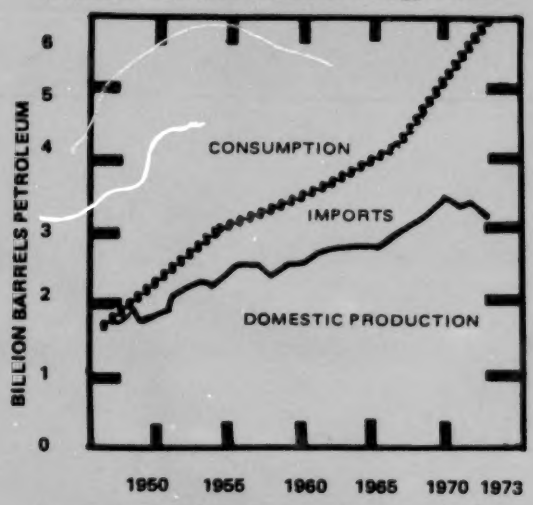
ENERGY ERROR: Tracy had an opportunity to buy a cord of white oak wood for $60, or she could get a rick of hickory and white oak for $35. During the year, she would burn over two cords so the amount of wood was not a problem. She wanted the better buy (wood at the lowest price). Tracy purchased the rick of firewood. Did Tracy make the better buy? Why?



A RICK OF WOOD

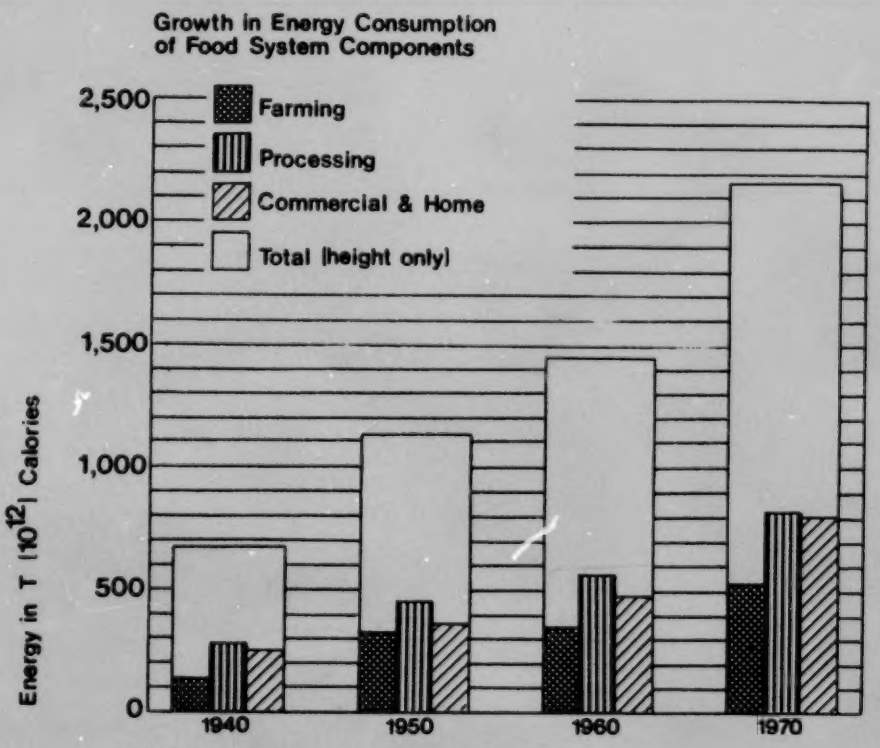
Source: TVA (Tennessee Valley Authority)

ENERGY ERROR: Bob Stevens was not one to keep his opinions to himself! He didn't believe that there was a real energy crisis. "The whole problem in 1973-74," he argued, "was a put up job by big oil companies and foreign oil producers. Oil companies ahave held down domestic oil production for years to make big bucks with foreigners!" He says that Americans can have plenty of petroleum in the future by banning oil imports and letting Americans produce more oil for fellow Americans right here at home. Has Bob made an energy error?



Source: U.S. Department of Energy

ENERGY ERROR: Mr. and Mrs. Harris were discouraged with the rising price of food in their weekly budget. They remembered the "good old days" when food cost far less. Mr. Harris blamed the higher prices on expensive energy used by farmers to grow food. Mrs. Harris agreed that farmers' energy cost them more, but the higher costs of energy were reflected in more than the farmers' costs. She said, "We process food more and transport it longer distances. We want and get foods that have been processed which takes energy. We eat out more, which also takes high priced energy." Has Mrs. Harris made an energy error?



SOURCE: National Science Teachers Association.

ENERGY ERROR: Sara and Alphonse discovered that red maple firewood was less expensive than the hickory wood they had been buying for their heat stove. Being dollar-wise shoppers, they saved $2.00 per cord by buying the red maple. George and Mary still bought the hickory, saying that it was cheaper than paying $2.00 less for the red maple. How could this be? Did Sarah and Alphonse make an energy error?

Available Heat per Air Dry Cord[1] and Its Equivalent Value Compared to Coal

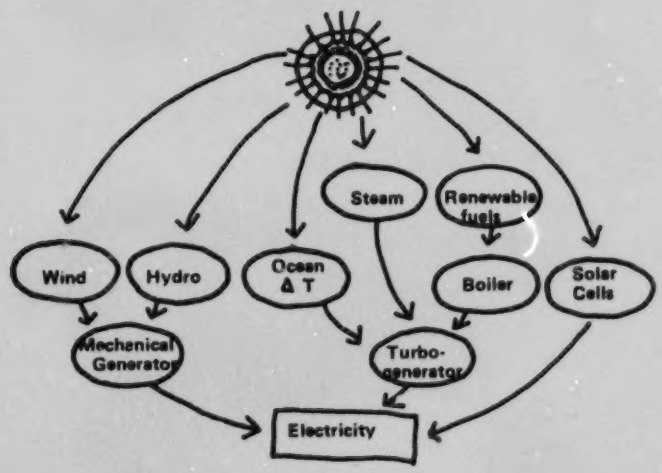
Species	Available Heat in One Standard Cord-Million Btu's	Equivalent Value With Stoker Coal At $60/Ton Delivered
Hickory	24.6	67.20
White Oak	22.7	62.40
Beech	21.8	59.40
Red Oak	21.3	58.20
Southern Pine	20.5	55.80
Red Maple	18.6	51.00
Elm	17.2	46.80

[1]Source: Table 38, Section 14, Page 74.FORESTRY HANDBOOK. One cord of 80 cubic feet solid wood at 20 percent moisture.

SOURCE: TVA (Tennessee Valley Authority)

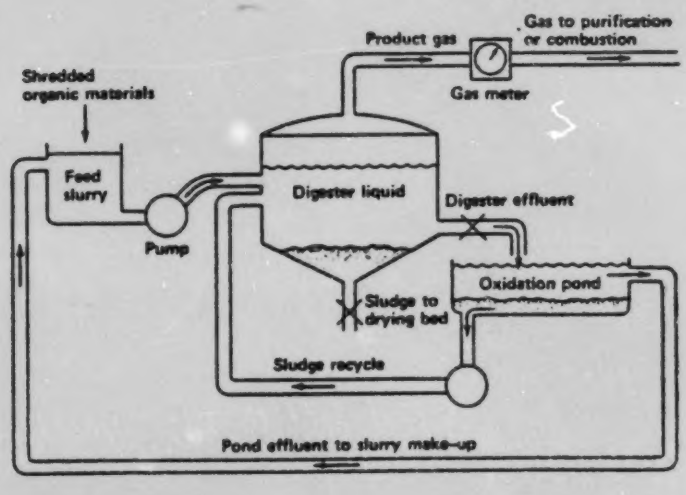
ENERGY ERROR: Ed Lewis lived near a city He installed a solar water heater on his home and saved money. He was pleased with the water heater, but lamented: "That's about the only thing we can do with solar. The sun's rays are hard to collect in a useful form. If only we could make electricity from solar!" Ed's neighbor argued that we could use solar to produce electricity. Examine the following diagram to get the drift of Ed's neighbor's thinking.

SOLAR ELECTRIC POWER



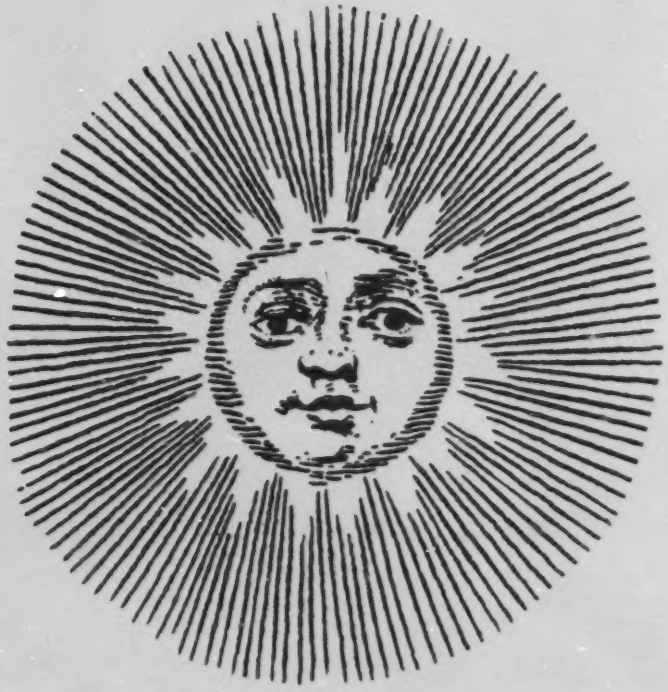
SOURCE: U.S. Department of Energy

ENERGY ERROR: Veula Johnson had lived near farms and cattle feed lots all of her life. Recently, she heard that B & W Cattle Company was using manure from feed lots to generate its own electricity. "That," she reasoned, "Sounds like a lot of bull. You cannot burn manure, you just plow it into soil to grow crops." Her son, Isaiah, argued that the company not only generated electricity they also plowed the manure into the soil! Veula wondered about that. Use the following chart to explain Isaiah's argument to Veula.



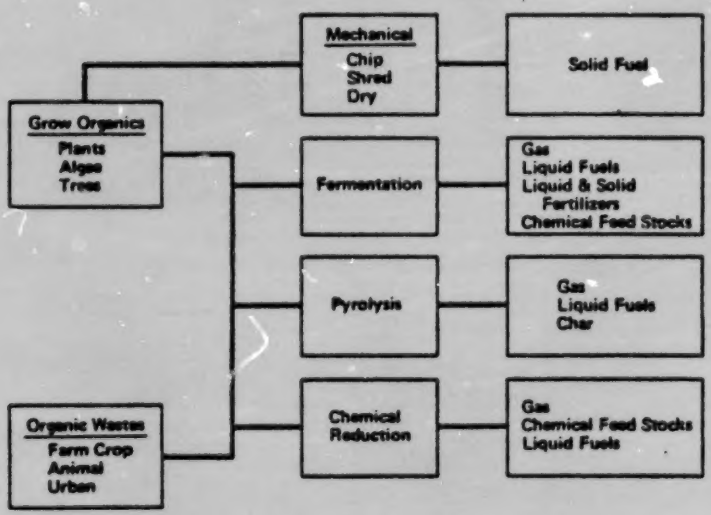
SOURCE: U.S. Department Of Energy

ENERGY ERROR: Larry is pround of his new, wood-burning stove. No longer will he have to depend on fossil fuels for heat. This September he went into the woods (with permission) and cut three cords of pine firewood. Now, in October he has it ready for use -- split and stacked by the kitchen door. Pine smoke smells great, curling out of the chimney on a cool morning! But his next-door neighbor, Mary, thinks that Larry has made two energy errors. Do you agree? What are they?



ENERGY ERROR: Admiral Felton (U.S.N, Ret.) argued that solar energy was nice and clean. But, he said, "It will never amount to much because the sun's energy is too diffuse and low-grade as it strikes the earth. Solar collectors are not efficient. We cannot use solar power to make fuels or to run local industries or to make electricity." His daughter, Renee, argued that solar could be used. Did Admiral Felton make an energy error?

SUN POWER



SOURCE: U.S. Department of Energy

ENERGY ERROR: While facing high electric bills, Carol has decided to get a solar water heater. Studies show that she is in an area where solar water heaters are cost effective. She has a choice between a $1,300.00 unit which will meet 70% of her hot water needs, and a very efficient $2,400.00 system which will meet 80% of her hot water needs. Carol, thinking that the "best is better," signs a contract for the $2,400.00 system. Has Carol made an energy error? How? Why?

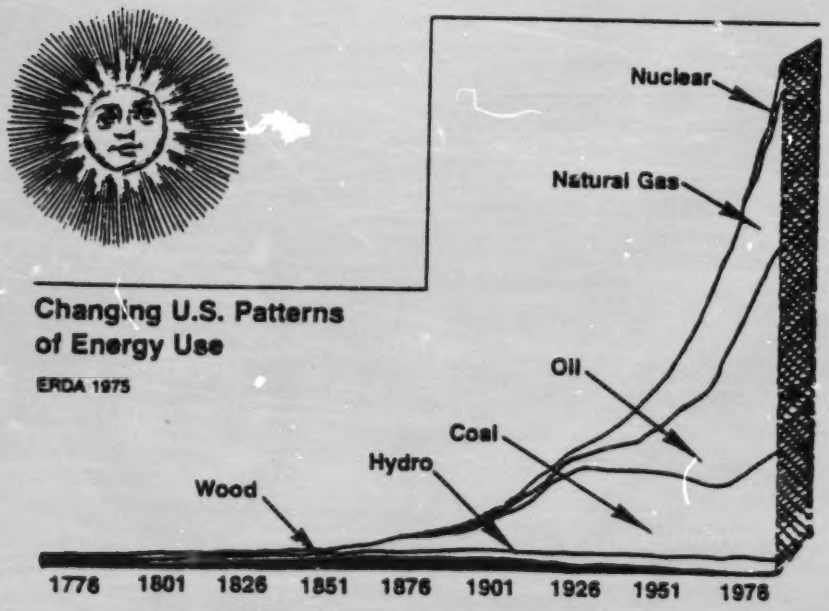
ENERGY ERROR: We in the United States have been increasing our use of petroleum ("oil") at about 7% per year. Many of us are worried about the future and talk about an "energy crisis." But imagine our response if tomorrow the newspaper announced the following:

> Oil has been discovered in Anartica. This discovery is equal to all the oil consumed by the United States--ever! It appears that the energy crisis is over. U.S. energy officials are elated. Said one, "We've got oil coming out our ears. This is a wonderful day for the people of the United States."

Have the energy officials and the newspaper reporter made an energy error?

Hint: exponential growth

ENERGY ERROR: The argument over the energy crisis was heating up around the coffee table. Mel saw the solution in terms of increasing development of nuclear energy and enhanced oil exploration. Others had their own favorite "solutions." But the most insistent advocate was Jim Allen who proclaimed about every three minutes: "The good old U.S. of A. once depended heavely upon wood as an energy source. It is clean and renewable. We have millions of acres for growing trees and other bio-mass sources. Let's forget O.P.E.C. and nuclear and go tree!" If you were involved in this discussion, how would you reasonable respond to Jim Allen?



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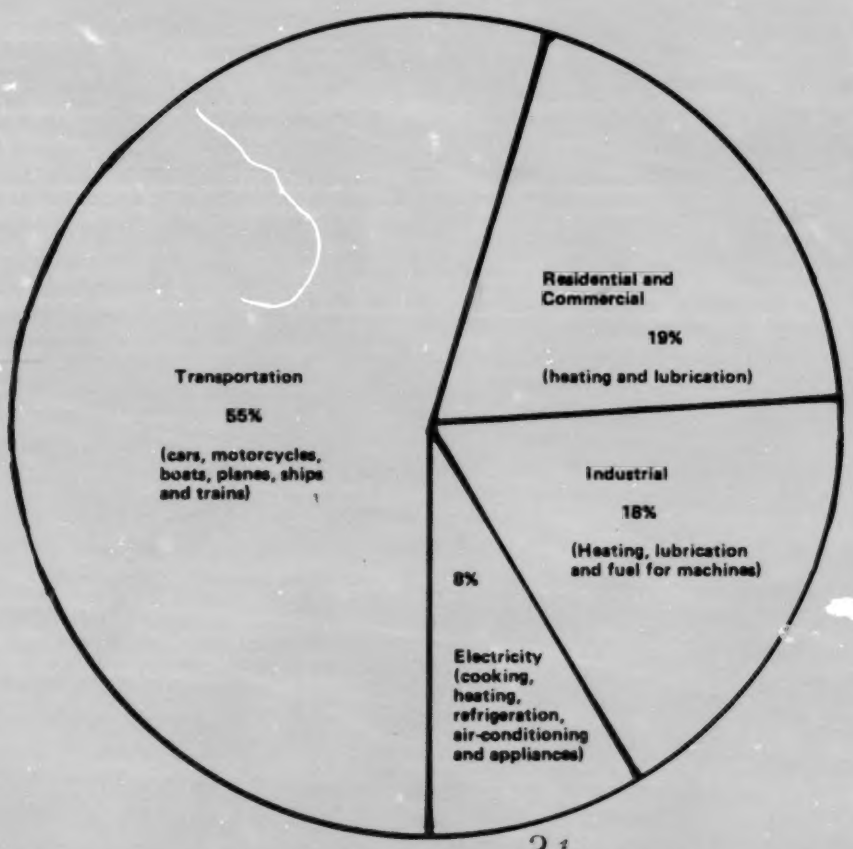
ACTIVITY 1 "Let's Get Off The About Industry's Back"

In a discussion with friends, Joe, a car salesman, argues that the pressure on the auto industry to produce fuel efficient cars is unwarrented. "we consume oil in lots of other ways", says Joe, "the government ought to drop these expensive fuel efficiency requirements and let the auto industry make cars that people can afford." "We can cut back on our oil imports and get the auto companies back on their feet."

Consider the graph below. Do you think Joe's argument holds water?

Major Users of Oil Supplies, 1971
Total Supply = 5.5 Billion Barrels



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Graph Source: Energy-Environment Mini-Unit Guide, National Science Teachers Association, Page 194.

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Activity 2 "Short-Term And Long-Term Savings"

You and your spouse are shopping for a new refrigerator-freezer for your kitchen. You have found two models which you like. Model "A" costs $545 and is a color which will match your other appliances. Model "B" costs $485 and is plain white. Being a young couple counting pennies you decide to buy model "B" and save some money, even though it is not the color you really want. Consider the information below and decide if you have made an energy error.

MODEL A

COST: $545.00

Refrigerator-Freezer
Capacity: 17 cubic feet

(Name of Corporation
Model(s) F117,F317
Type of Defrost: Full Automatic

ENERGYGUIDE

Estimates on the scale are based on a national average electric rate of 4.97¢ per kilowatt hour

only models with 16.5-18.4 cubic feet are compared in the scale

Model with lowest energy cost $50

$51
THIS MODEL

Model with lowest energy cost $88

Your cost will vary depending on your local energy rate and how you use the product. This energy cost is based on U.S. Government standard test.
How much will this model cost you to run yearly?

Cost per kilowatt hour	YEARLY COST
2c	$21
4c	$41
6c	$62
8c	$82
10c	$103
12c	$124

Ask your salesperson or local utility for the energy rate(cost per kilowatt hour) in your area.

IMPORTANT: Removal of this label before consumer purchase is a violation of federal law(42 U.S.C. 6302)

(Part No. 371028)

MODEL B

COST: $485.00

Refrigerator-Freezer
Capacity: 17 cubic Feet

Name of Corporation
Model(s) AH503, AH[illegible]4, AH507
Type of Defrost: Full Automatic

ENERGY GUIDE

Estimates on the scale are based on a national average electric rate of 4.97¢ per kilowatt hour

only models with 16.5-18.4 cubic feet are compared in the scale

Model with lowest energy cost $50

$70
THIS MODEL

Model with lowest energy cost $88

Your cost will vary depending on your local energy rate and how you use the product. This energy cost is based on U.S. Government standard test.
How much will this model cost you to run yearly ?

cost per kilowatt hour	YEARLY COST
2c	$28
4C	$57
6c	$85
8c	$[illegible]3
10c	$142
12c	$170

Ask your salesperson or local utility for the energy rate(cost per kilowatt hour) in your area.

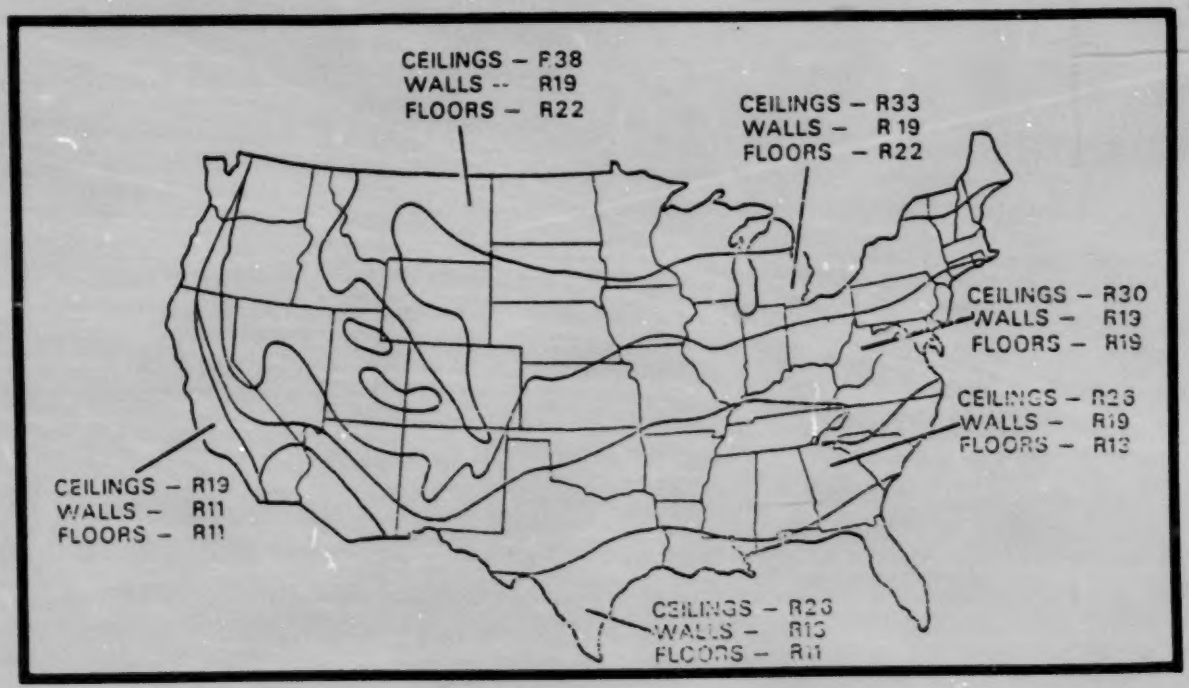
IMPORTANT: Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

-30-

Activity 3

"Can you have too much insulation?"

Jean is building a home in central Florida. She wants to make it as energy efficient as possible and is willing to spend a little extra now to get long term energy savings. Believing the more insulation she has the better off she'll be, Jean decides to put R38 rated insulation in the ceilings, R19 insulation in the walls and R22 insulation in the floors. Consider the information below and decide if you think Jean has made a wise decision.



Recommended Levels Of Insulation For Regions Of The U.S.

ACTIVITY 4

PROJECT REEN

R.E. Davies

"DEVELOPING A HEALTHY SKEPTICISM"

In any reading we do which may influence our opinion about important issues it is advisable to read with a questioning mind.

The following can be used to help students develop such skills. It should be used conjunction with Shell Answer Book #25-The Energy Independence Book. It is available from Shell Oil Company, P.O. Box 61609, Houston, Texas 77208.

1. Consider the photographs on the front cover and page 2 of the booklet. What conclusion do you think they wish you to draw?

2. On page two in the second paragraph, the booklet states that the main reason that we are presently unsure about our future energy supplies and their cost is our dependence on other countries for oil Why do you think we have become so dependent on foreign countries for oil? As you read further in the booklet see if you can determine who the oil company blames for this dependence.

3. In answering the question, "what difference does it make where the oil comes from?" the booklet indicates that by getting oil from foreign sources we're sending money to pay for the oil out of the U.S. Do we send money to foreign countries for any other commodities? Is there a way to reclaim all of this money and have it flow back into the U.S. ?

4. On page four in answer to the question "Wouldn't exporing for oil on public lands " foul up" the environment?" the answer is a flat no. Do you accept this without question? Have you read or heard any differing opinions?

5. In discussing the question, "Why not just use more coal? We've got plenty of that", it is statedthat the U.S. has enough coal to last at least 300 years at the same rate we are using it now. If we increase the amount of coal we use, what will do to the amount of time we can expect the coal to last? If we are going to make coal a big supplier of our future energy, would it be wise to export as suggested?

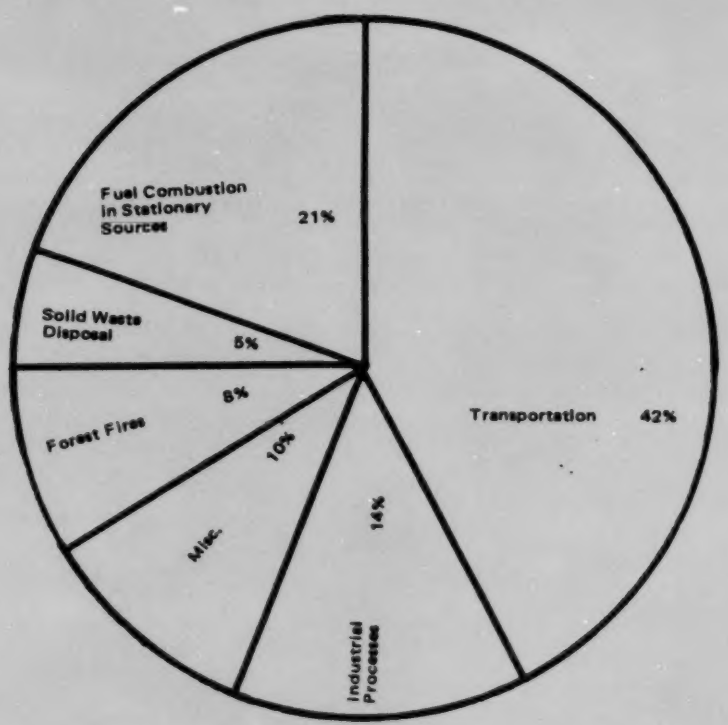
6. What is the purpose of the picture on page 5? Have you heard any differing opinions regarding the issue in question?

7. In discussing the question on pages 4 and 5 relating to exploration and exploitation of oil, gas and coal resources, who is blamed for the lag in exploration and utilization?

"Clean Air or Cheaper Cars?"

Reducing clean air standards has been suggested as a way of helping out an ailing auto industry. If fewer pollution control devices are needed, it is argued, the price of a car will be reduced and more people will buy them. Consider the graph below and decide if allowing auto's to pollute more might have an important influence on air quality.

FIGURE 1-4
Sources of Air Pollution

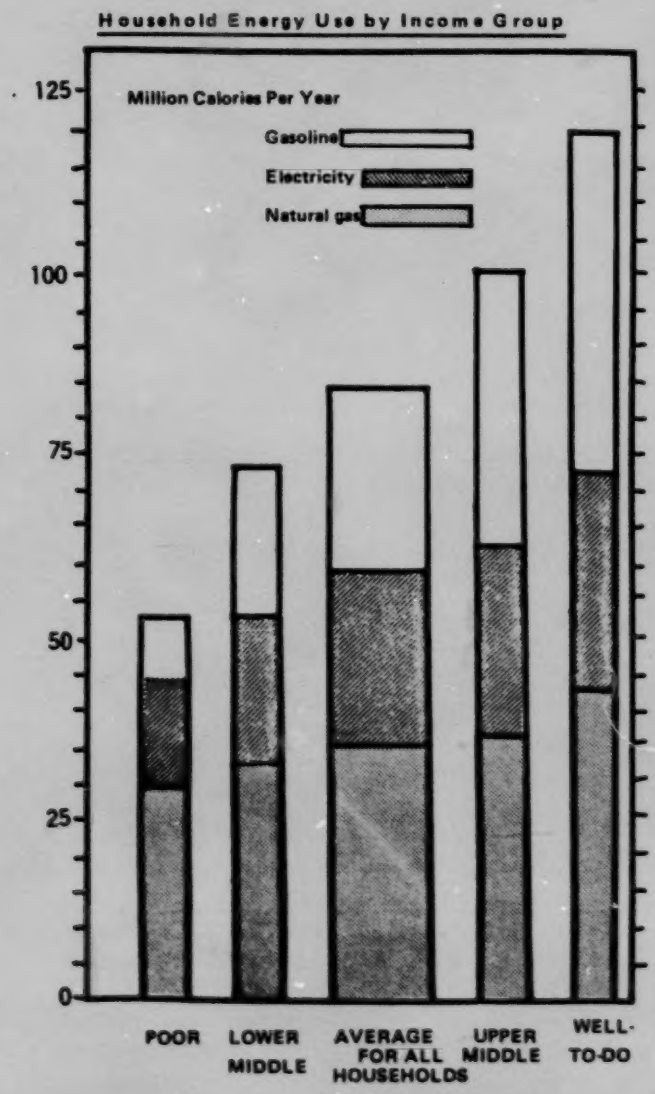


From: National Science Teachers Association, Energy-Environment Source Book, Page 5.

Activity 6

"Everybody Needs To Conserve"

We are all being encouraged to conserve energy as our nation trys to deal with a changing energy situation. Consider the graph below. Do all persons in America consume equal amounts of energy? What implications does this have for energy conservation? Removing government controls and allowing energy prices to rise is one way that has veen suggested to encourage more conservation. If energy prices rise, who will be most pressed to try and conserve energy?



Source: Washington Center for Metropolitan Studies.
Note: Includes only natural gas, electricity, and gasoline.

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R.E. Davies

Activity 7

"Is Wood The Answer?"

Wood stoves are becoming more and more popular as people search for ways to cut back on energy costs. What does the information below indicate about wood as an energy source? Does this give you enough information to make a good decision about buying a wood stove to heat your home? What additional information might you need?

Energy Content of Various Fuels

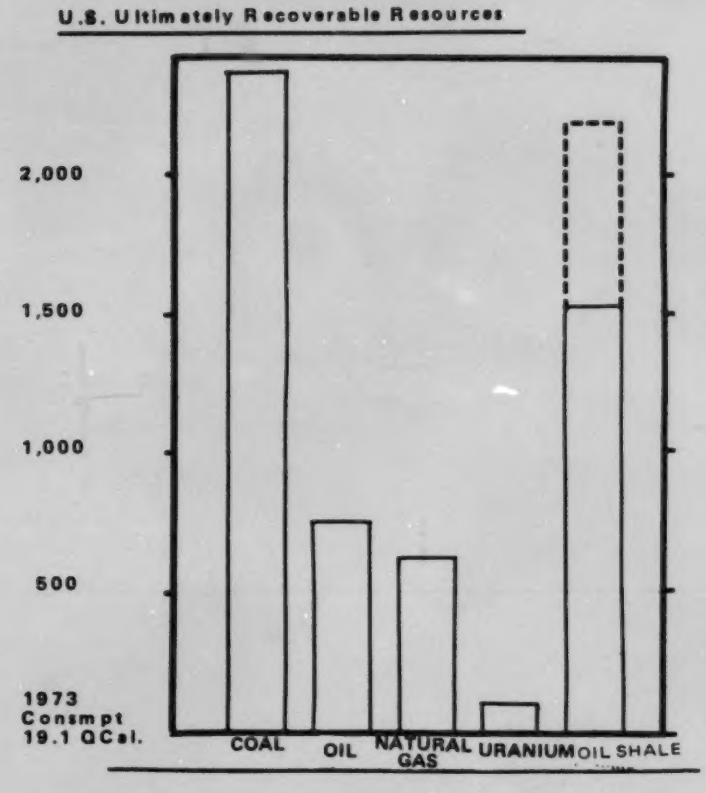
Fuel	Amount	Energy Equivalent (M Calories)	Energy per Pound (Calories)
Coal			
Soft coal (bituminous)	one ton	6.1	3,100
Hard coal (anthracite)	one ton	6.4	3,200
Oil, distillate (including diesel)	barrel	1.5	4,900
Gasoline	barrel	1.3	4,800
Natural Gas	1,000 ft^3	.26	5,000
Wood	1 cord[b]	5.3	1,250

[a] Million.
[b] One cord is a pile of wood 4 ft. long, 4 ft. high, and 8 ft. long.

Activity 8

"Can Nuclear Power Solve Our Energy Problems?"

Many pople are looking to nuclear power to solve our energy porblems. They believe that developing present nuclear technology will provide a long range solution to the production of electricity in the face of dwindling supplies of fossil fuels. Consider the information below. Are these people making an energy error?



FROM: National Science Teachers Association, Energy-Environment Source Book, page 123.

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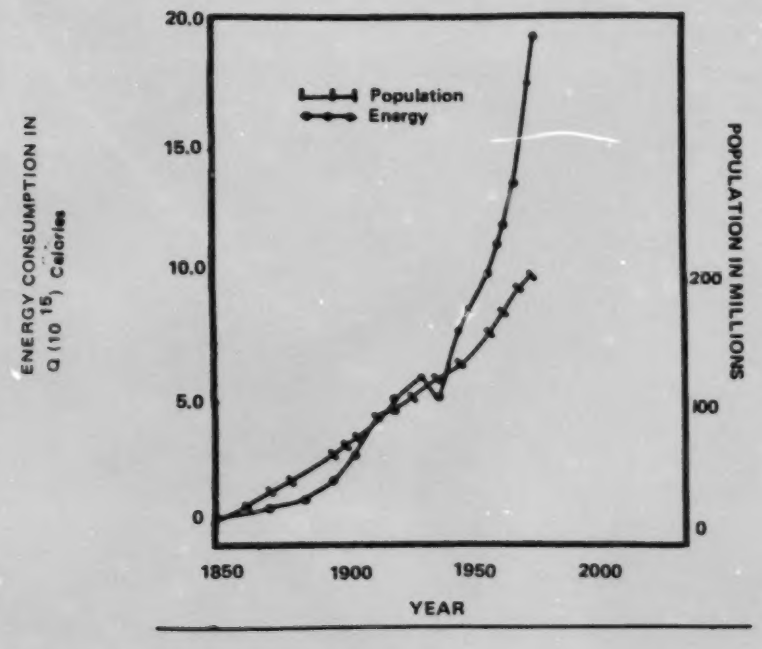
Activity 9

"More People-More Energy"

"More people mean more energy consumed, thats all there is to it," Pete claimed. "If we can stop the growth of the population of the U.S. , we can curb increases in our energy use," Is Pete's analysis correct? Check the information below and state your case.

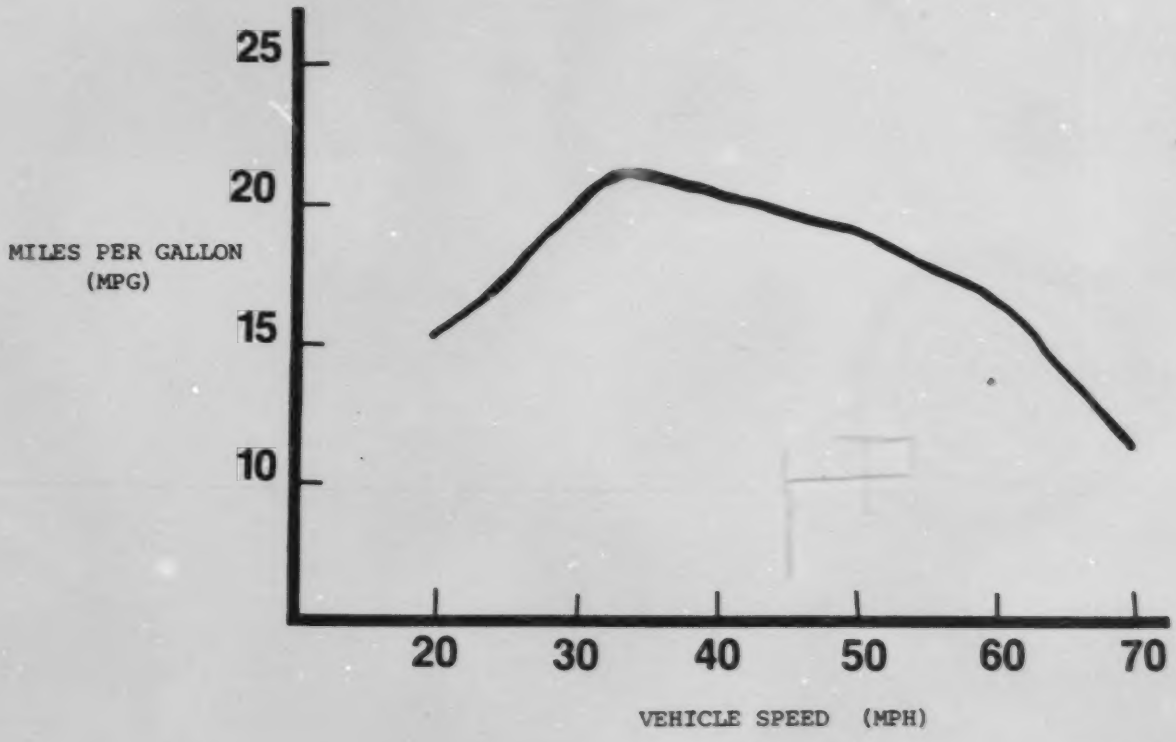
Historical Record of U.S. Population Growth and Energy Consumption



Activity 10

"How Slow Should We Go?"

"This 55 mph speed limit has got to go," argued Senator Jones. "It is not right to make people drive so slowly on the super highways we have spent billions of dollars to build." "Americans ought to drive faster if they want." Consider the graph below. Has Senator Jones made an energy error?



ENERSKILL:DETECTING BIAS

DIRECTIONS: Read each article below. Then answer the questions that follow.

A Petroleum Parable

Once upon a time, last week in fact, a meeting was held in the august headquarters of the U.N. to hear the grievance of an Arab diplomat. He reportedly pleaded: "We ask for gasoline to be allocated for diplomats because they are in a terrible situation." Said his loyal assistant: "We are using a lot of gas. We have to stand in line, and this is affecting our work."

How true this tale was. And how initially refreshing. The gasoline lines in New York City indeed snake to the horizon. Even the natives may purchase gas only on an odd day here, an even there. Lo, how it heartened them to know that the inconvenienced diplomat was Salah Omar al-Ali, the ambassador from Iraq, he whose land has helped make oil dear as gold.

Alas, his plight may have fallen upon sympathetic ears. A U.N. Committee will discuss letting the diplomats use a pump in the building's basement so that they will be spared the gas-line woes of the natives.

Moral: the squeaky wheel can get the oil.

TIME, July 16, 1979
Page 10

Hikersprotest N-plant

More than a dozen "Walkers for Energy" hiked Into Portland Sunday in route to the Trojan nuclear power plant to protest against nuclear power.

The walk started in Astoria last June 24 and will end Sunday at Trojan. The hikers, accompanied by a truck filled with exhibits of alternate sources of energy, spent Sunday afternoon and evening at Portland's Duniway Park.

At dusk they walked to the Park Blocks bearing candles to dramatize their opposition to nuclear energy. The 400-mile walk from Astoria through Tillamook, Newport, Florence, Eugene, Corvallis, Salem and Portland publicized solar and wind power as alternate souces of energy, explained Avram Friedman, one of three supporters who has hiked the 400 miles.

THE OREGONIAN, Monday,
August 13, 1979 Page A13

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Questions:

1. Were the articles written to inform or to present a point of view?
   HIKERS PROTEST:
   A PETROLEUM PARABLE:

2. Is the writer sympathetic or unsympathetic in HIKERS PROTEST: (Article is neither sympathetic nor unsympathetic.)
   A PETROLEUM PARABLE:

3. What words arrouse sympathy, discredit the subject, or do none of these?
   HIKERS PROTEST:
   A PETROLEUM PARABLE:

Discussion questions. Answers will vary.

4. How do you feel about the diplomat after reading the article?

5. Whose fault is it that the diplomat is having to stand in a gas line?

6. Who do you feel sorry for after reading the article?

7. Do you agree that the ambassador's country has made "oil dear as gold"? Explain.

8. Who would most likely agree with the point of view of
   HIKERS PROTEST:
   A PETROLEUM PARABLE:

ENERSKILL NAME_____

IDENTIFYING RELEVANT AND IRRELEVANT INFORMATION: CONGRESSIONAL INVESTIGATION OF OIL PRICES

The information that is valuable to consider in making a decision is called RELEVANT information. Information that would not be helpful in making a decision is called IRRELEVANT information.

With the 400 percent increases in the price of foreign oil and the feeling by many people in the United States that the oil companies created shortages to get higher prices and larger profits, a congressional committee has been called to investigate the oil companies' price increases. You have been hired by the committee to organize their investigators. Since you are limited in the number of investigators you have available, you are to make sure they spend their time investigating information that will help the committee make its decision. Place an X by the information below that is most relevant and will help the committee decide whether oil prices and profits are set too high.

_____ 1. Unused refinery capacity

_____ 2. Oil reserves held by companies

_____ 3. Salaries of top executives of oil companies as compared to others.

_____ 4. Profits made by local service stations

_____ 5. Percent of ownership of foreign oil supplies by local producers

_____ 6. Oil reserves that are not now being drilled for by oil companies

_____ 7. Profits made on the past years by oil companies

_____ 8. Vacation taken by oil company employees

_____ 9. The number of oil company employees in labor unions

_____ 10. The public opinion about the size of oil company profits

ENERSKILL NAME_____

IDENTIFYING VALUE STATEMENTS: UNITED STATES ENERGY PROBLEM

"Values are beliefs about what are desirable and undesirable goals and about ways of reaching goals." The Psychology of Human Behavior, page 311

Which of the following 10 statements are statements of values according to this definition of values?

1. Approximately 45 percent of the oil consumed in the United States in 1978 came from wells located outside of the United States.

2. The best solution to rising oil prices is to switch to solar energy as much as possible.

3. During the civil war in Iran no oil products were being shipped from that country.

4. In 1973 the OPEC nations quit selling oil to the United States until the United States agreed to pay more for the oil.

5. If the OPEC nations refuse to sell oil to the United States in the future, the United States should refuse to sell food to the OPEC nations.

6. The government's main concern should be to hold down the price of gasoline and fuel oil.

7. Consumers' main concern chould be the reduction of their oil and gasoline usage.

8. Operation Independence was the government attempt to produce as much oil in the United States as is used in the United States.

9. Canada has decided not to export any oil to the United States.

10. Mexico has a supply of natural gas that the United States would like to buy.

Take your paper to your teacher for correction.

ENERSKILL NAME _____

DETERMINING BIAS:NUCLEAR POWER AND THE ENVIRONMENT

When people take a stand on an issue, they make decisions about what information they think is important to believe or disbelieve. This decision is usually based on their past experiences and their desired results. These experiences and desired results give each person their own particular BIAS. In the statements below indicate the bias being shown in each statement.

Place an "X" by the statements made by someone SUPPORTING nuclear power.

Place a "Y" by the statements made by someone OPPOSED to nuclear power.

_____1. Plutonium remains dangerous for 25,000 year.

_____2. If a nuclear plant ever "melts down," millions may die.

_____3. No one has ever been killed by an accident at a nuclear power plant.

_____4. We don't have any place that will safely store nuclear wastes.

_____5. The rest of the world is building nuclear plants as fast as they can.

_____6. Many workers in uranium mines have gotten cancer.

_____7. Nuclear power creates no pollution for smoke like coal does.

_____8. We are going to run out of other fuels before we have enough nuclear plants.

_____9. With more nuclear power plants, the United States would not have to be so dependent on the Middle East.

_____10. Terrorists could threaten to destroy a nuclear plant to get what they wanted.

_____11. Waste water from nuclear plants can ruin the river or lake it is dumped into.

_____12. The United States has sufficient reserves of uranium to avoid the need for foreign imports for at least 50 years.

_____13. Very few nuclear plants have been built lately because of protests by local communities.

_____14. Several major cities are now getting more than 50 percent of their power from nuclear plants.

PROPAGANDA TECHNIQUES IN ENERGY EDUCATION

Gail Foster

GRADE LEVELS: Junior High and above

OBJECTIVES: To identify and to give examples of propaganda techniques for the purpose of building rational decision-making skills.

SEQUENCE OF ACTIVITIES:

1. Teacher will review the rationale and revise hand-outs, if necessary.
2. Students will bring in examples of advertising.
3. Propaganda techniques will be introduced and hand-outs distributed.
4. Students will find examples of each propaganda technique in advertising. Radio & T.V. commercials may be used. Role playing maybe valuable.
5. Students will bring in articles on energy.
6. Students will identify specific propaganda techniques within the articles.
7. Group discussion may involve changing values and how they are affected by propaganda.
8. Groups may plan advertising campaigns or write energy articles using propaganda to encourage conservation. Videotape productions could be planned and performed.

SPECIFIC SKILLS:

1. Students will be able to identify specific propaganda techniques in advertisements and commercials.
2. Students will be able to identify specific propaganda techniques in articles based on energy.
3. Students will be able to utilize propaganda to encourage conservation.

RESOURCES:

Advertisements
Energy--related articles
Hand-outs
The Propaganda Game (wff'n Proof, optional)

EDUCATION PROCEDURES: Rationale

The energy crisis is alarming. In ancient Chinese the word "crisis" was written with two characters. The first meant "danger," but this danger does not automatically endow educators with license to indoctrinate. Rather than yield to this tendency, recall that the Greek root of the word crisis means "decision." Thus decision making skills should be a primary objective in energy education.

Propaganda Techniques - I

The Institute for Propaganda Analysis lists seven common propaganda techniques.

1. Name Calling - Applying some label that people generally dislike or fear to a person, organization or idea. Such words as "racist" or communist" may be used to discredit rather than describe accurately.

   Example - "Only an idiot would believe nuclear power can solve our nation's energy problems."

2. Gillttering Generality - Connecting positive - sounding words to an idea, so that you will accept the idea without examining it.

   Example - "Farmers are the life blood of our country, harvesting energy from the sun to feed America. They can help solve our energy problems through gasohol."

3. Transfer - Using the reputation of some respected organization in connection with an idea.

   Example - "The Union of Concerned Scienctists estimate that 10 to 17 percent of our uranium miners will die of cancer."

4. Testimonial - Quoting some well-known person in favor of a given product or Policy.

   Example - "Energy Analyst Charles Kormanoff recently published an exhaustive study that shows electricity from nuclear plants will cost 20 to 25 percent more than power from modern coal plants with advanced pollution - removing scrublers."

5. Plain Folks - Winning confidence on the basis that an idea is good because it is related to the common people.

   Example - "Ladies and gentlemen of the jury, the defendant cannot possible be guilty of tampering with his electric meter to defraud the utility company, for he comes from a long, long line of hard-working, God-fearing, liberty-loving, and patriotic people just like yourselves."

6. Card Stacking - Selecting and using facts to give a false or misleading idea.

   Example - "Nuclear plants in the U.S. run at only 5 percent of their capacity."

7. Band Wagon - Urging you to follow the crowd and accept the idea because "everybody's doing it."

   Example - "...meeting the nation's energy needs should be a great national cooperative effort that enlists the imagination and talents of all Americans."

Propaganda Techniques -II

1. Appeal to Pity - Seeks to produce sympathy and pit to influence your opinion.

   Example - "America's poor, already trapped by rapidly rising prices for food and housing, are expected to be hardest hit by a 50¢ a gallon tax on gasoline."

2. Appeal to Prestige - Urging the acceptance of an idea as a means of raising your status.

3. Appeal to Ridicule - Attempting to make fun of someone or something in order to influence your opinion.

   Example - "Conservation is ignored in the President's energy budget. Obviously, conservation is not good business for the oil companies that donated $280,000 to redecorate Ronald Reagan's White House living quarters."

4. Bargain Appeal - Attempting to get you to buy an item by appealing to your desire to save money.

   Example - "This is your last chance to buy a brand new Opex automobile at 1981 prices."

5. Appeal to Flattery - Attempting to persuade by flattering a person in an area inwhich he would like to excel.

   Example - "Physically fit students tend to use bikes for transportation in order to conserve our valuable natural resource."

6. Slogan Appeal - Promotes a favorable response or positive action through short, catchy phrases.

   Example - "Save It, Florida." "Extinct Is Forever."

7. Technical Jargon Appeal - Impresses with the use of technical language or unfamiliar words.

   Example - "Durawear tires contain durium, the bonding material that makes these tires wear for years."

8. Danger/Survival Appeal - Refusing to act in a certain manner will result in harmful consequences.

   Example - "The Union of Concerned Scientists predicts a one-in-five chance of a catastrophe for one of our current reactors during their 30 to 40 year lifespan."

SOURCES-Some examples were based up an article in the Tallahassee Democrat entitled "We Don't Need Nuclear Power" by Ira Scorr, June 21, 1981.

Chevron energy report:

In 1979, Chevron made a nickel on a sales dollar.

But, most people think we made ten times that much.

A recent independent nationwide survey found that people believe, on the average, that oil company profits are about 57¢ on each sales dollar. That just isn't the case.

Actually, Chevron's 1979 profit on each dollar of U.S. petroleum sales was 5.1¢—about a nickel. Worldwide it was 5.3¢. (This compares to a 9-month average of 5.6¢ for all other major U.S. industries.)

Part of Chevron's profit, of course, went back to our shareholders. The remaining profit and other cash from operations provided the funds for Chevron's expenditures in such areas as exploration and development of oil and gas fields, refineries, and transportation facilities.

In the U.S., these expenditures were equivalent to 10.7¢ per dollar of U.S. petroleum sales, more than double our U.S. profit.

Thank you for listening. -47-

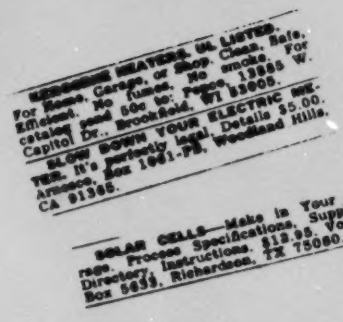
57¢ *What most people think is oil company profit on a sales dollar, after taxes.**

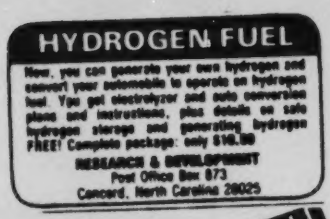
5.1¢ *Actual 1979 Chevron U.S. profit on a sales dollar, after taxes.*

*Public Opinion Index, Opinion Research Corporation, August, 1979.

Chevron

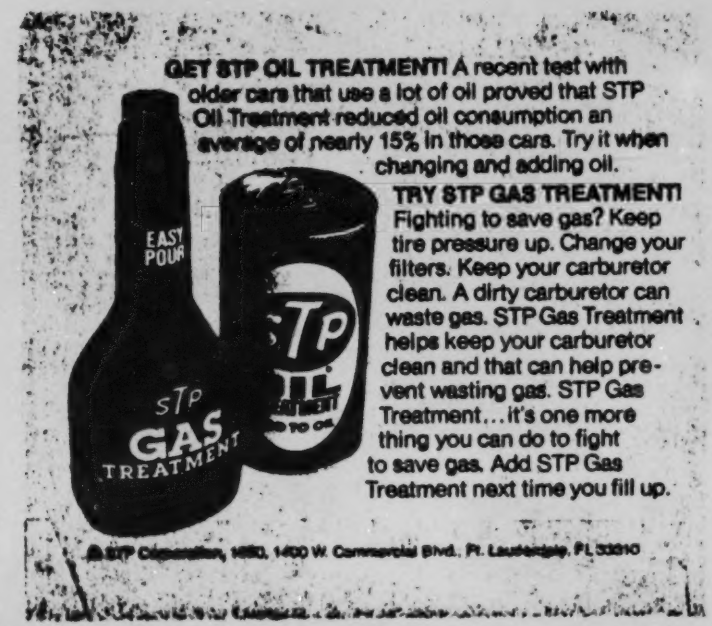
SAMPLE ADVERTISEMENTS

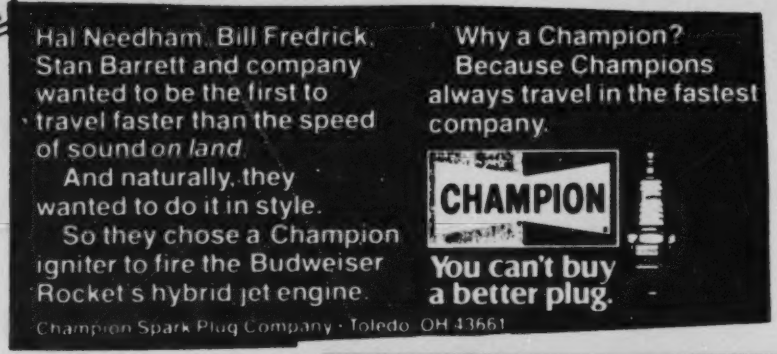

For Home, Garage, or Shop. Clean, Safe, Efficient. No fumes. No smoke. For catalog send 50¢ to: Pegco, 1986 W. Capitol Dr., Brookfield, WI 53005.
BLOW DOWN YOUR ELECTRIC METER. It's perfectly legal. Details $5.00. Amsco, Box 1041-PS, Woodland Hills, CA 91365.
SOLAR CELLS—Make In Your Garage. Process Specifications, Suppliers Directory, Instructions. $13.95. Vortex, Box 5693, Richardson, TX 75080.


HYDROGEN FUEL
Now, you can generate your own hydrogen and convert your automobile to operate on hydrogen fuel. You get electrolyzer and auto conversion plans and instructions, plus details on safe hydrogen storage and generating hydrogen FREE! Complete package: only $16.95
RESEARCH & DEVELOPMENT
Post Office Box 873
Concord, North Carolina 28025

Solar power

Looking for independence from electric utilities? This solar-panel system—cells, batteries, controls—can help with 500–650 watt-hours per day. A catalog ($1) from Solarwest Electric (1124 Coast Village Circle, Santa Barbara, Calif. 93108) details bigger systems.


GET STP OIL TREATMENT! A recent test with older cars that use a lot of oil proved that STP Oil Treatment reduced oil consumption an average of nearly 15% in those cars. Try it when changing and adding oil.
TRY STP GAS TREATMENT! Fighting to save gas? Keep tire pressure up. Change your filters. Keep your carburetor clean. A dirty carburetor can waste gas. STP Gas Treatment helps keep your carburetor clean and that can help prevent wasting gas. STP Gas Treatment...it's one more thing you can do to fight to save gas. Add STP Gas Treatment next time you fill up.
EASY POUR
STP
GAS TREATMENT
STP
STP Corporation, 1650, 1400 W. Commercial Blvd., Ft. Lauderdale, FL 33310


Hal Needham, Bill Fredrick, Stan Barrett and company wanted to be the first to travel faster than the speed of sound on land.
And naturally, they wanted to do it in style.
So they chose a Champion igniter to fire the Budweiser Rocket's hybrid jet engine.
Why a Champion? Because Champions always travel in the fastest company.
CHAMPION
You can't buy a better plug.
Champion Spark Plug Company · Toledo, OH 43661

"That's living proof that offshore platforms aren't ecologically destructive. A two-year study by twenty Gulf Coast universities, concluded in 1974, says the same thing.

"Gulf people are meeting a lot of challenges in getting the oil out while preserving the environment. This problem just seemed to solve itself; and with continual environmental monitoring and sampling, on all current and future offshore sites, we intend to make sure it stays solved."

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Union poster:

ENERSKILL: LOOKING AT TWO SIDES OF AN ISSUE: THREE MILE ISLAND

Directions: Read each account below carefully. But before you begin, review the following tips that lead to a better understanding of the arguments used to support support a particular point of view:

- Separate facts from opinions.

- Guard against the broad statements that may not be true in all situations.

- Avoid emotion-loaded words.

Then , answer the questions that follow the readings.

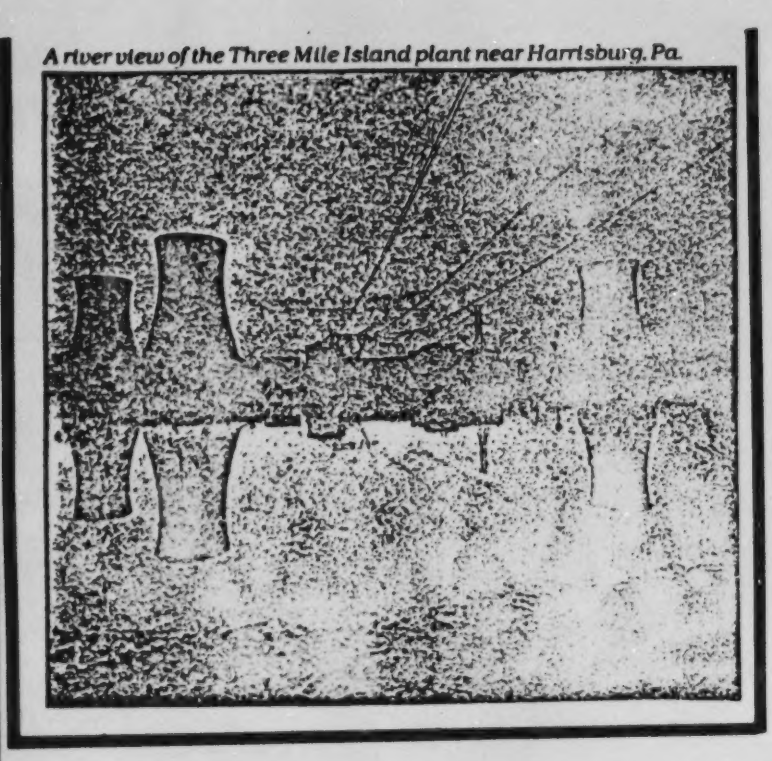
A. THREE MILE ISLAND

An apparently routine pump failure in a nuclear reactor is compounded, by a combination of technical flaws and human errors, into a serious accident involving the release of considerable radioactivity into the atmosphere. For some days after the event, the inability of the reactor's safety system to cope with an unanticipated development (the generation of a large bubble of hydrogen gas in the reactor containment vessel) posed the imminent threat of the most serious of possible reactor calamities--a core meltdown. Public confidence in nuclear reactor safety and its management is seriously eroded, not only by the facts of the accident but also by the falsifications, evasions and generally irresponsible handling by company officials and some public servants of the information released to the public on the specific details, dangers and possible consequences of the accident, especially in the early, crucial stages.

B. THREE MILE ISLAND

A sequence of events resulting form a pump failure at a reactor causes the reactor to shut down. The emergency cooling system manages to cope with the technical failure and to prevent a dangerous loss of coolant, in spite of a number of technical problems encountered, most but not all anticipated. Although there results some relatively small release of radioactivity unto the surroundings, almost all the radioactivity is contained within the reactor complex. The net result of what could, in the absence of careful advanced planning, have been a serious accident will be the loss of an important local source of electricity for a considerable period. However, in spite of over-blown fears expressed by badly informed critics, not a single individual has been physically injured.

Source: The Bulletin of the Atomic Scientists (May 1979, p. 6) : author, Bernard T.Feld



A river view of the Three Mile Island plant near Harrisburg, Pa.

1. What is the issue being debated?

2. In View A, who is accused of being irresponsible?

3. In View B, who is accused of irresponsibility?

4. How does A's opinions affect your feelings ?

5. How does B affect you?

6. Which do you think is the best argument by each side?

   A's argument:

   B's argument:

7. What other evidence would you find helpful in making up your mind on the issue of Three Mile Island.

8. Which point of view do you support? Why?

ENERGY PERSUASION

One central fact of life is that persons are always trying to persuade us to accept a position or conclusion about what is good, beautiful, or true! There are all sorts of methods which they use on us. For example, someone might offer the following list of "facts" in hope that we will draw their conclusion:

> If you're a typical driver, your car:
> - travels over 11,000 miles per year
> - consumes nearly 800 gallons of gasoline annually (just over 2 gallons per day)
> - has an average fuel economy rating of 14 to 15 miles per gallon, and
> - costs over $600 per year for gasoline alone (over 5 cents per mile).

In this case, the conclusion we are supposed to accept is to drive our cars in ways which are cost effective --that is, energy efficiently.

Sometimes, we are offered statements which are partially true, or which omit certain information. For example, Shell Oil in one of its publications noted that:

> The United States has enough coal to last at least three hundred years at the rate we're using it now. In fact, we've got so much, we could even become a major coal exporter.
>
> Unfortunately, concern over mining coal, transporting it and burning it clearly is keeping us from using as much coal as we need.

Notice that we only have 300 years of coal at current rates of consumption. If we export coal (as suggested) we reduce those years rapidly. The concept of exponential growth is critical to discern this point. Also, notice the use of "unfortunately" in the second paragraph. What is that intented to suggest about "concern over..." using coal?

Teachers might try the four exercises on the next page with their students. In Case A the suggestion is that the trucks will last a long time, without considering how long they have been making trucks or the percentage of trucks by other manufacturers which are still functioning.

In Case B, the conclusion desired is that their microwave overs will save 30% of our energy in cooking. We need data on cooking the same meal in a microwave and in a conventional oven before we can make real comparisons.

In Case C, the first impression is that $250,000 is greater than $300,000, and that we should recoup our investment rapidly.

In Case D, the salesperson is avoiding giving us the actual gas mileage. We at least need to know the size of the gasoline tank!

CASE A

A company claims "90% of all our trucks sold in the last 10 years are still being driven today."

What conclusion do they want you do draw?

If you knew that 90% of all vehicles sold in the past 10 years are still on the road, how is the conclusion changed?

If the manufacturer has just begun to manufacture the trucks four years ago, how would that change the conclusion?

CASE B

A manufacturer states"This microwave oven saves you 30% more energy."

What conclusion do they want you to draw?

What do you need to know before you can really draw that conclusion?

CASE C

An opponent of the mass transit system complains, "This city spent a quarter of a million dollars improving the mass transit system and the revenues were only $300,000."

What would be your first impression based on this imformation?

CASE D

A recreational vehicle salesman states that this motor home "will go 300 miles on a tank of gas."

What is he avoiding telling you?

What do you need to know in order to compute miles per gallon based on this data?

SOURCE: National Science Teachers Association.

Using Statistics and Graphs

You are a politician running for office in an area where gaoline conservation is an important issue. Given the following information, draw a graph to show you have saved a great deal of gasoline in the last year.

MONTH	GAS CONSUMPTION IN GALLONS	MONTH	GAS CONSUMPTION IN GALLONS
JAN.	55	JULY	47
FEB.	54	AUG.	46
MAR.	52	SEPT.	45
APR.	52	OCT.	43
MAY	50	NOV.	42
JUNE	49	DEC.	40

Draw a second graph the way your opposition might present the same data showing your savings to be very insignificant.

What is your percent of savings from January to December?

SOURCE: National science Teachers Association.

How Can Graphs Mislead You?

When a bar graph does not begin with 0 (truncated graph), one tends to see the proportion between one bar and another rather than the actual amount of difference.

MOTOR BIKE SALES ARE SKYROCKETING!

1. Bicycle sales are increasing -- what kind of increase is implied by the graph?

2. How would the effect of the graph be changed if the scale began with 0?

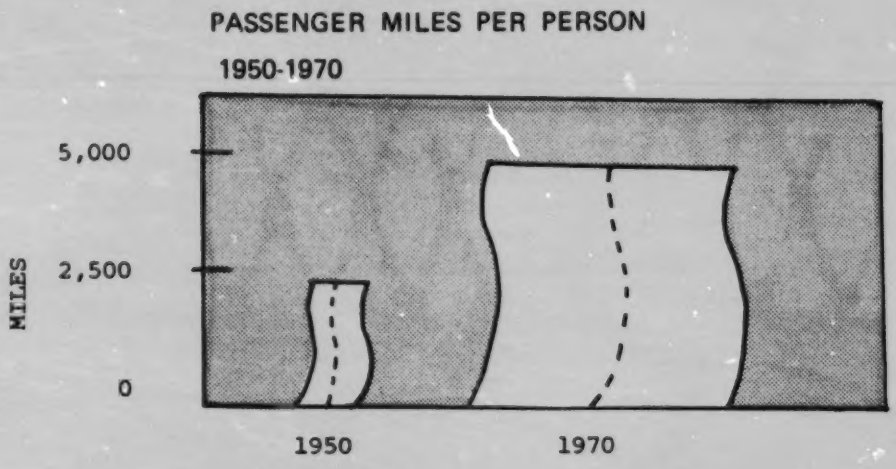
3. Using the following formula, what is the actual percent of increase?

$$\frac{\text{1979 sales figure} - \text{1977 sales figure}}{\text{1977 sales figure}} \times 100 = \text{percent of increase}$$

SOURCE: National Science Teachers Association.

More About Graphs That Can Mislead

In this pictograph the scale begins at 0, but the effect is still deceptive.



1. What does this pictograph seem to imply ?

2. How much is the actual increase in passenger miles per person?

SOURCE: National Science Teachers Association.

ENERGY PERSUADER: One group concerned about energy and the future of the United States published the following passage. How did they try to limit (restrict) our thinking about energy and our future?

The United States faces a choice of two energy futures.

In the one commonly foreseen by analysts writing in 1979 and 1980, our present energy problems would continue for years to come—and probably get worse. These problems—foreign oil supply cutoffs, price shocks, gasoline lines—have shown Americans that we are losing control of our energy affairs. Our economy, our job security and our way of life are threatened if this future becomes the reality.

But in the other, far more attractive future, we could reasonably expect to regain much of the energy security that we lost during the 1970s. Our nation would have a good chance to cut its dependence on oil imports sharply from the early 1980 level—perhaps by as much as one-half by 1990. This future would require neither miracles nor great self-sacrifice—only common-sense decisions.

ENERGY PERSUADER: Another group published the passage which follows. Who do you think would take this kind of position on our energy problem? What might their interest be in the energy problem facing the United States?

A strong competitive free market system stimulates efficient production of energy and other goods and services. It encourages investment in research, more efficient machines, tools, equipment, and other capital goods necessary to improve productivity. The free market system benefits people, supplies resources to support social programs and improve the quality of life, and provides the taxes that pay for government.

An understanding of our economic system and how energy relates to our overall productivity and well-being will help us take a reasoned approach to controversial energy, ecology, and economic issues

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ENERGY PERSUADER: Another group wanted to have an impact upon our thinking about the conflict between our energy needs and the value we place upon wilderness areas. How is the following passage persuasive? How does it mislead our thinking?

Obviously, everyone wants to preserve areas like the Grand Canyon and Yellowstone Park. But federal lands include much broader areas that do not have special scenic or historic value. These lands could contribute their full potential if more of them were explored for energy resources. However, energy exploration and development are prohibited or severely restricted on about two-thirds of the federal onshore lands. This is an area nearly five times the size of California. Offshore, less than 4 percent of the OCS has ever been leased

Years of experience have shown us that we can both produce energy and preserve our nation's scenic beauty. To help us move toward both goals, the government can:

- recognize energy production as one of the high priority uses for federal lands;
- permit orderly access to federal lands for development of energy by responsible, competitive private companies; and
- coordinate overlapping responsibilities and resolve contradictory regulations of the many agencies that manage federal lands.

ENERGY PERSUADER: A second group wrote about the same conflict. how is their passage misleading and persuasive?

Q. If finding more oil and gas in America can help, why don't we get on with it?

A. As much as ⅔ of our oil and gas that is still to be found lies under public lands onshore and off which are controlled by the Federal government. This 1.3 billion acres equals about 44 percent of the entire United States land area.

Unfortunately, much of this land is off limits to oil and gas exploration and development because of a multitude of laws and regulations.

Today public lands account for only 17 percent of our oil and gas, but they could account for a lot more.

Q. Wouldn't exploring for oil on public lands "foul up" the environment?

A. No. Oil and gas production, onshore and off, has been going on in America for decades. With virtually no adverse effect on people's lifestyles, wildlife or scenic values.

ENERGY PERSUADER: One group published the following list of facts about our national energy situation. What conclusion did they seem to want us to draw about what we should do to "solve" the energy problem?

- We have crude oil and natural gas equal to 40 years of production at today's levels.
- We have three times as much coal and twice as much shale oil as oil and gas.
- We have enough uranium to sustain the nuclear power industry well into the next century.
- We are just beginning to tap renewable sources, including solar, geothermal and biomass energy.

We have the additional "resource" of energy conservation which is already making a significant contribution.

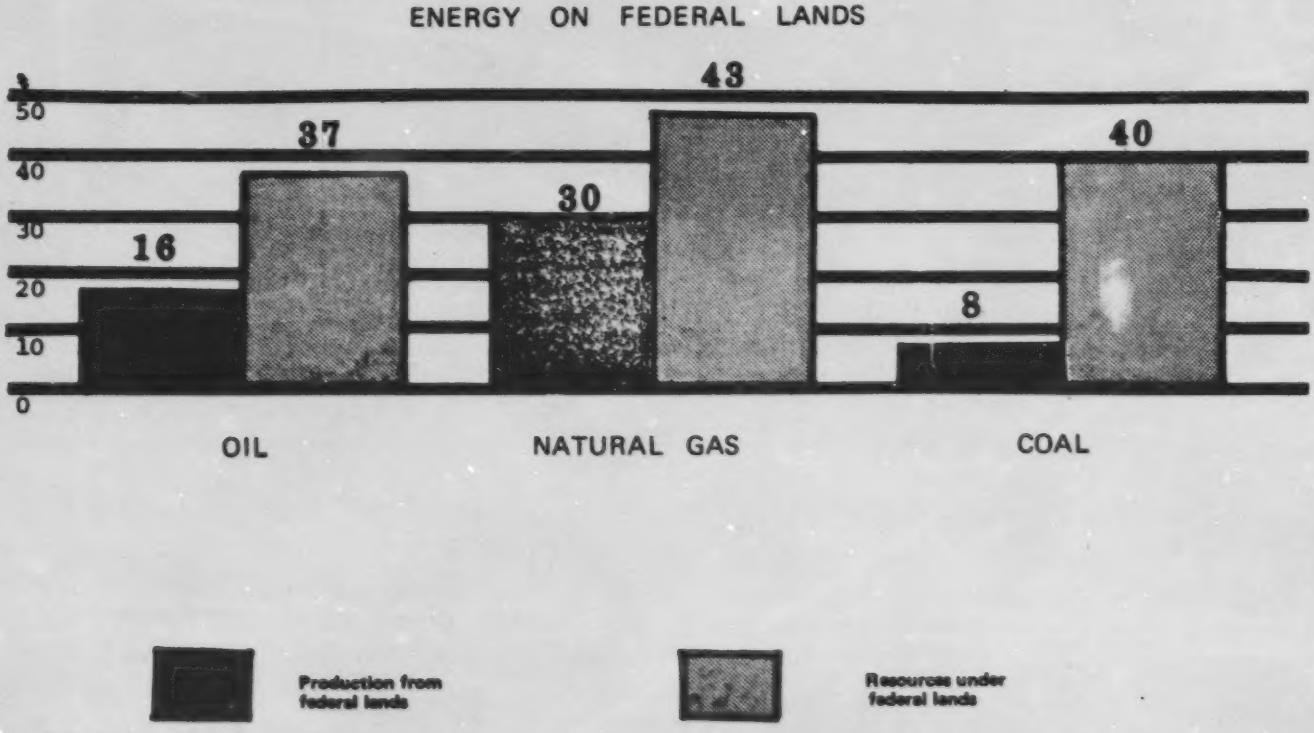
ENERGY PERSUADER: Another group published a pamphlet listing desireable benefits of following certain energy policies. Look over the list of benefits. What do you think that the group would like the government to do as ways to "solve" the energy problem?

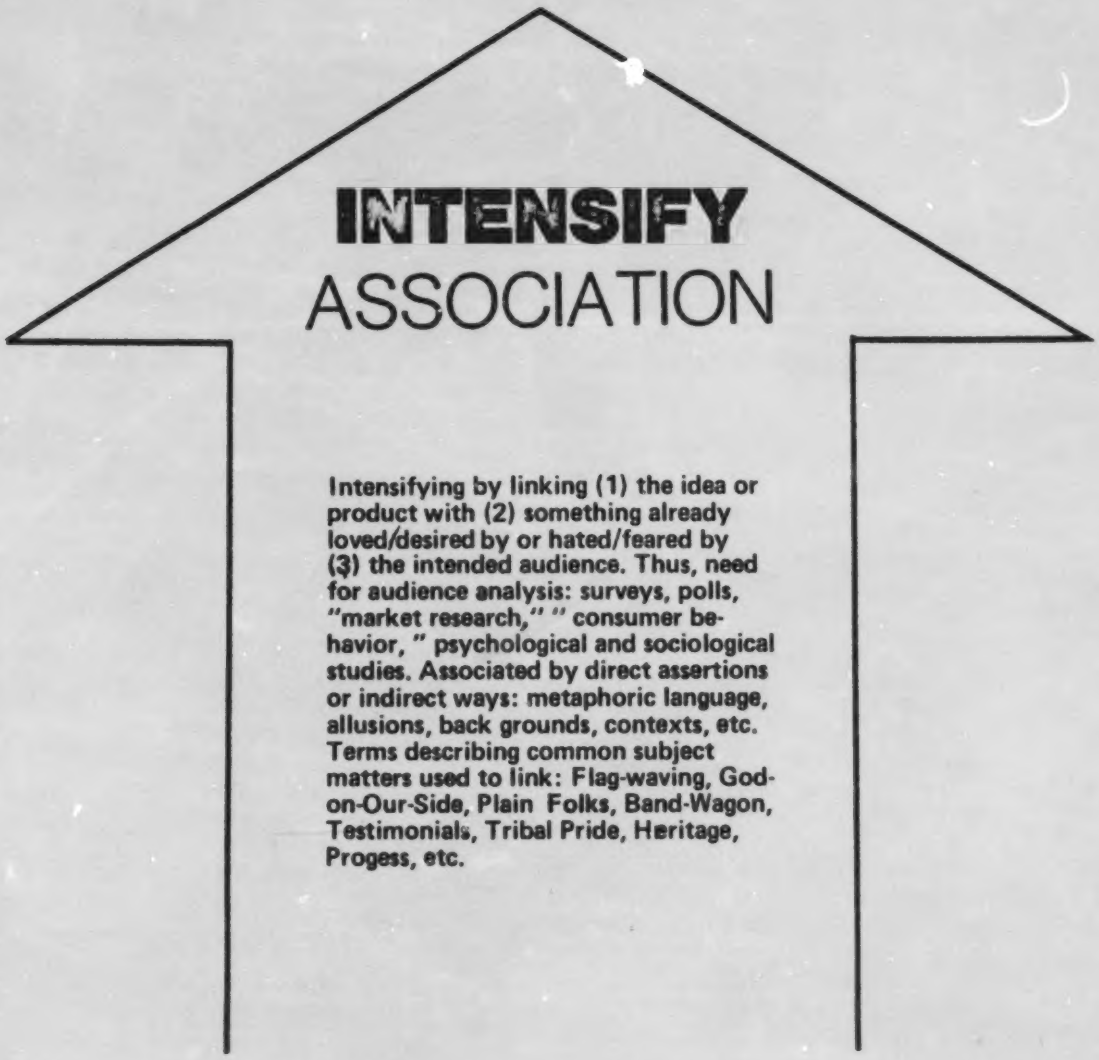
- *Jobs could be more secure* because there would be less chance of layoffs caused by sudden energy shortages.
- *More goods and services could be available* because more U.S. resources would remain in our country to be used more efficiently.
- *Inflation could be lower and wages higher* because more money would be available for investment that spurs productivity.
- *Increases in fuel prices—at home and at the pump—could be restrained* because the ability of oil-exporting countries to raise world prices could be reduced.
- *Prices of imported goods could be held down* because a lower oil import bill would strengthen the dollar.
- *Personal lifestyles could be more secure* because oil-exporting countries would have less power over American lives—on highways, in homes and at work.

ENERGY PERSUADER: One company introduced its booklet on the American energy problem with the following passage. Obviously, the "most Americans" phrase was a persuasive technique. But how did the company try to narrow our thinking about the real cause of the energy problem?

> If you're like most Americans, you have two real concerns about energy. Are you going to have all your need? And what's it going to cost? The answers, unfortunately, are "maybe" and "a lot".
>
> The main reason for both of these bad situations is simple. We've become dangerously dependant on other countries for our oil.

ENERGY PERSUADER: Another company published the following graph showing the energy resources on Federally-owned land in the United States. What impression did they seek to make upon us by showing us this information?





Intensifying by linking (1) the idea or product with (2) something already loved/desired by or hated/feared by (3) the intended audience. Thus, need for audience analysis: surveys, polls, "market research," " consumer behavior, " psychological and sociological studies. Associated by direct assertions or indirect ways: metaphoric language, allusions, back grounds, contexts, etc. Terms describing common subject matters used to link: Flag-waving, God-on-Our-Side, Plain Folks, Band-Wagon, Testimonials, Tribal Pride, Heritage, Progess, etc.

DIRECTIONS: Choose an ad from a newspaper or magazine to use as an example of intensifying by association. Clip the example to the back of this sheet after you have answered each question below. Base your answers on the total content of the ad.

1. Who is saying what to whom?

2. With what intent?

3. What market research, surveys, polls, or audience analysis are referred to?

4. What indirect persuasion is used? For example, what metaphors are associated with the product?

5. Bandwagon, testimonials, Plain Folks, ect. --which of these techniques are used, if any? Explain.

6. What attitude(s) would the ad writer like you to form?

Intensifying by repetition is an easy, simple, and effective way to persuade. People are comfortable with the known, the familiar. As children, we love to hear the same stories repeated, later, we have "favorite" songs, TV programs, etc. All cultures have chants, prayers, rituals, dances based on repetition. Advertising slogans, brand names, logos, and signs are common. Much education, training, indoctrination is based on repetition to imprint on memory of the receiver to identify, recognize, and respond.

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DIRECTIONS: Choose an ad from a newspaper or magazine to use as an example of intensifying by repeating. Clip the example ad to the back of this sheet after you have answered each question below. Base your answer on the total content of the ad--words, pictures, repetition of type, repetition of letters, syllables, etc.

1. Who is saying what to whom?

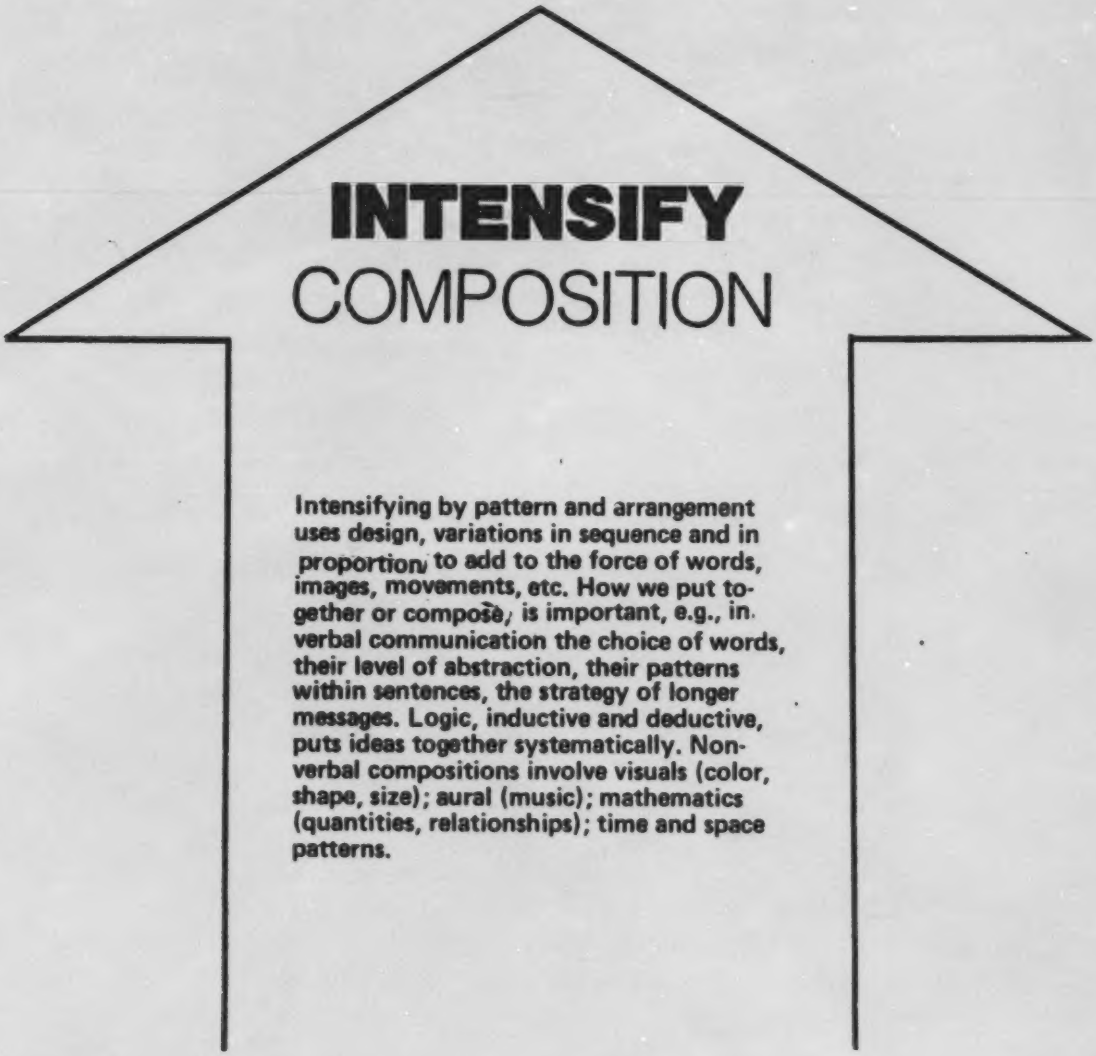
2. With what intent?

3. With what idea or ideal is the product associated?

4. How does the ad writer make this association? For example, what facts are used to stress the association? What repetition devices are used? (List and underline these where necessary.)

   FACTS USED REPETITION USED

5. Pictures often reinforce the relationship between the actual product and the attitude advertisers would like customers to form. Does this happen in this ad? Explain.



Intensifying by pattern and arrangement uses design, variations in sequence and in proportion to add to the force of words, images, movements, etc. How we put together or compose, is important, e.g., in verbal communication the choice of words, their level of abstraction, their patterns within sentences, the strategy of longer messages. Logic, inductive and deductive, puts ideas together systematically. Nonverbal compositions involve visuals (color, shape, size); aural (music); mathematics (quantities, relationships); time and space patterns.

DIRECTIONS: Choose an ad from a newspaper or magazine to use as an example of intensifying by composition. Clip the example to the back of this page after you have answered each question below. Base your answers on the total content of the ad.

1. Who is saying what to whom?

2. With what intent?

3. What images intensify the main idea?

4. What appeals are used to attract the target audience to this ad, to make them want to buy this product?

5. What facts are used in the copy?

6. What facts are probably left out? What are they leaving out?

7. How does the pattern of the words and the design in which they are used add to the impact ?

Downplay by omission is common since the basic selection/omission process necessarily omits more than can be presented. All communication is limited, is edited, is slanted or biased to include and exclude items. But omission can also be used as a deliberate way of concealing hiding. Half-thruths, quotes out of context, etc. are very hard to detect or find, Politicial examples include cover-ups, censorship, book-burning, managed news, secret police activities. Receivers, too, can omit, can "litter out" or be closed minded, prejudiced.
DOWNPLAY
OMMISSION

DIRECTIONS: Choose an ad from a newspaper or magazine to use as an example of downplaying by omission. Clip the example to the back of this sheet after you have answered each question below. Base your answers on the total content of the ad.

1. Who is saying what to whom?

2. With what intent?

3. What does the ad tell you about the product or what people should be concerned about?

4. Is there evidence that this product or proposal will be capable of solving the problem being presented?

5. What else would you want to know before you can make a choice about what to buy or think about or act on?

Downplaying by distracting focus, diverting attention away from key issues or important things: usually by intensifying the side-issues, the non-related, the trivial. Common variations include: "hairsplitting," "nit-picking," "attacking a straw man," "red herring"; also, those emotional attacks and appeals (ad hominem, ad populum), plus things which drain the energy of others: "busy work," legal harassment, etc. Humor and entertainment ("bread and circuses") are used as pleasant ways to divert attention from major issues.

DOWNPLAY
DIVERSION

70

DIRECTIONS: Choose an ad from a newspaper or magazine to use as an example of Downplaying by diversion. Clip the example to the back of this sheet after you have answered each question below. Base your answer on the total content of the ad.

1. Who is saying what to whom?

2. With what intent?

3. What is probably the real purpose of this ad?

4. How is the unaware reader diverted from the real message? For example, does the writer intensify side issues or the non-related to distract the reader from the real issue?

5. Does the company or organization exaggerate the good things about the product or idea and play down the bad effects or possible dangers?

Downplaying issues by making things so complex, so chaotic, that people "give up","get weary,"overloaded." This is dangerous when people are unable to understand, comprehend, or make reasonable decisions. Chaos can be the accidental result of a disorganized mind, or the deliberate flim-flam of a con man, or the political demagogue (who then offers a "simple solution" to the confused.) Confusion can result from faulty logic, equivocation, circumlocution, contradictions, multiple diversions, inconsistencies, jargon or anything which blurs clarity or understanding.

DOWNPLAY
CONFUSION

72

DIRECTIONS: Choose an ad from a newspaper or magazine to use as an example of downplaying by confusion. Clip the example to the back of this sheet after you have answered each question below. Base your answers on the total content of the ad.

1. Who is saying what to whom?

2. With what intent?

3. Does the ad appeal more to your reasoning or to your feelings? Why might the advertiser want to do this?

4. Does the ad assume something is true that has yet to be proved?

5. Does the ad generalize from insufficient evidence or offer no solid proof?

6. Does the ad withhold facts which will hurt the organization's cause?

7. What statements confuse rather than explain something clearly?

CAR POOLING SYSTEM

A government agency in a large urban community is introducing a "Rideshare" program which uses a computer to match up prospective car pool participants by neighborhood and destination. An incentive of the program is preferential lane treatments which allows cars with four or more riders to use an express lane during rush hours. Your task is to develop a television commercial giving the telephone number of "Rideshare" and requesting people to call in and sign up.

ADVANTAGES

1. Participants will lessen their commuting time.
2. Participants will save both money and goasline and reduce maintenance on personal vehicles.

DISADVANTAGES

1. Participating in a car pool lessens personal flexibility.

FACT

Car pools are useful, convenient and their implementation would greatly reduce traffic congestion into large urban areas.

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NATURAL GAS HOME

Several builders backed by a regional natural gas association are offering an all natural gas energy package with discounts on the heating and cooling system, range, refrigerator and dryer if bought under this total package. At the time of this campaign there is a local oversupply of natural gas and your job is to design a television commercial to market the "all natural gas" home.

ADVANTAGES

1. Substantial savings can be made on the price of the appliances if they are bought as a package.
2. Natural gas is clean, convenient and currently is in good supply and favorably priced.

DISADVANTAGES

1. During the past few years, data shows seasonal shortages of natural gas and in some parts of the country, natural gas supplies have been exhausted.

FACT

National projections show that natural gas will decline in supply and domestic supplies will be exhausted in around thirty years. This is about the same length of time as current home mortgages.

COMPACT CAR

A major automobile manufacturer is announcing the introduction of a new compact car which has been designed to achieve high gasoline mileage. The vehicle is of the "shoe" design with capacity to hold four people in a very small volume. Your job is to name the vehicle and write an advertisement.

ADVANTAGES

1.This car achieves mileages in the top one percent of all vehicles. (over 40 miles per gallon.)
2.With four riders, this vehicle offers the lowest cost per mile of all vehicular transport systems.
3.Easy to park in congested areas.

DISADVANTAGES

1. With four riders, this car offers no creature comfort and long trips are very uncomfortable.
2. This car has little or no acceleration when carrying at full capacity.

FACT

While offering real savings in fuel economy, this vehicle will offer only a spartan transportation mode at best. Compact cars of this volume also have a high damage and high fatality rate in moving accidents.

MASS TRANSIT RIDERSHIP

Develop a television advertisement whose goal is to increase the rider density on a middle sized urban mass transit system. While the bus system had been in operation for several years it has a low appeal public image. Recent bond issues have resulted in upgrading the service and the transit board needs to increase the ridership to make the system cost effective.

ADVANTAGES

1. There are real benefits to the community in that if a 20-30 percent increase in ridership is achieved, the mass transit system can become self-sustaining and pay its own maintenance and administration costs.
2. The overall fuel consumption of the community will stabilize or decrease based upon higher passenger density in the mass transit system.

DISADVANTAGES

1. Mass transit riders have limited flexibility. Except for rush hours, buses run only once per hour with limited routes on Saturday and Sunday.
2. Round trip tickets cost $1.00 per day which is not competitive with four person car pools.

FACT

The transit system is probable economical and convenient for day workers in the downtown area. However, the inconvenience and cost detract from mass transit as a primary transport for all citizens.

ELECTRIC AUTOMOBILE

This vehicle is being introduced during the middle of long gas lines in cities and suburban areas. Your task is to name the vehicle and develop an advertisement. Your vehicle is a compact, battery operated car with a range of forty miles and a battery charging cycle of twelve hours.

ADVANTAGES

1. Electric automobiles can furnish low cost per mile transportation in urban areas.
2. You do not need gasoline or other liquid fuels.

DISADVANTAGES

1. The short range of the vehicle limits its usefulness.
2. The long recharge period limits the time the vehicle can be used.
3. The vehicle is expensive, costing over $6000.

FACT

The vehicle is effective for short, low speed trips. It uses high cost batteries which must be changed yearly. The mechanical components of the electrical system require weekly cleaning and maintenance and the vehicle must be driven a minimum of 100 miles per week over a three-year lifetime to be competitive with compact gasoline vehicles.

THREE DECISION-MAKING CASES:
ENERGY NEEDS VS. OUR ENVIRONMENT

Sometimes energy needs and environmental concerns conflict. The following activities will give students a chance to think about these conflicts and how they affect the energy situation.

CASE #1

You are a member of the U.S. House of Representatives Committee on Natural Resources. You have just heard testimony from Exxon concerning the need for oil exploration in the Touchek Mountain area in the Flathead National Forest. The oil company says that seismographic tests show that this area could be one of the richest oil finds in years. You recognize the need for more domestic oil discovery because of the increased reliance upon foreign oil, but you are hesitant to grant exploration in this area because you have also heard testimony from the Montana Wilderness Society and the Sierra Club. These groups have been working for years to get the Touchek Mountain area designated as National Wilderness land, which would protect it from road building, development, mining, and drilling. These environmentalists point to destruction of wildlife habitat, in particular, that of the grizzly bear which is nearing extinction in the lower 48 states. On the other hand, as the oil company spokesperson said, public land should be used to benefit the greatest number of people, not just a few wild animals and backpackers.

What would your decision be? Why?

DISCUSSION:

1. List the costs and the benefits that would result from oil exploration in an untouched wilderness area.

2. At what point do the costs of energy production out-weigh the benefits?

3. How should public land be used?

ROLE PLAY: SELECT STUDENTS TO PLAY THE FOLLOWING ROLES

6 Congresspersons to serve on the U.S. House Committee on Natural Resources
1 Sierra Club spokesperson
1 Exxon spokesperson

Committee members may cross-examine each speaker after their testimony.

Committee members discuss among themselves and vote on the issue.

CASE #2

You serve on the Board of Directors for Seminole Electric Cooperative. The Board has decided to build a new coal-fired electric generating plant in the near future in order to meet the growing energy needs in south Florida. You have chosen two sites: one on a Bluff over looking the Appalachicola River, west of Tallahassee, and one in Taylor County, near Perry. The Appalachicola site is preferred because it would pave the way for more development on the relatively undeveloped river (which makes developers and influential business people supportive), plus the river itself would provide an easy way to transport coal to the plant (on barges).

The problem is that, although the county Commissions of all the counties along the river have unanimously approved the plant's location, environmentalists are organizing to oppose it. A group of local people, calling themselves "Friends of the Appalachicola", have spoken their opposition, along with the Sierra Club. The Florida Department of Environmental Regulation has also disapproved the site as detrimental to the river because the river would have to be dredged and straightened to allow the passage of large coal barges. A well-known F.S.U. biology professor has become outspoken and there are rumors of a coalition of fishermen and women who make thier living from the Appalachicola Bay. Taylor County, on the other hand, seems to be welcoming you with open arms.

What would you do?

DISCUSSION:

1. Should utility companies ever bow to the wishes of environmentalists? Why or why not? If so, when?

2. Do you think that environmentalists are impeding progress in the field of energy? How? Should they be ignored?

3. How can a decision-maker weigh the needs of energy against the needs for environmental quality?

4. What other factors (besides political opposition) might influence your decision in this case?

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CASE #3

You are the sheriff in the town of Seabrook, New Hampshire. A utility company is in the process of building a nuclear power plant in your town. Twice, the voters have shown their opposition to the plant by voting against the plant's construction. The plant continues to be built. The City Selectmen (much like a city commission down here) even voted to turn off the water to the construction site, but that decision was over-ruled by court order.

Now, members of the Clamshell Alliance, the name of the New England anti-nuke movement, are planning a massive non-violent civil disobedient action. They plan to move onto the construction site (trespass) and camp there in order to hold up construction and demonstrate their opposition. They are aware that they will be breaking the law and may be arrested, but say that the plant will be doing a much greater harm to society by operating a dangerous facility and creating toxic radioactive wastes that will remain lethal for 250,000 years, thus endangering future generations.

The utility company sees this disruption of their activities as lawless disrespect by a few "hippy types" who want to impede progress. They say that the plant will be safe and produce great amounts of needed energy. They want the demonstrators prosecuted to the fullest extent of the law in order to discourage future actions.

Last year, before you were elected sheriff, 1500 members of Clamshell Alliance were arrested in a non-violent sit-in at the plant. After their arrest, they refused to pay bail and had to be housed for two weeks in National Guard Armories, which cost the taxpayers of New Hampshire a great deal of money.

This year's action will have an even bigger turnout of participants and you will have to deal with the problem. You are sworn to uphold the law and those anti-nuke activists will clearly be breaking the law. On the other hand, you are worried about that nuclear plant also because you have several children and are concerned about their future. What should you do?

DISCUSSION:

1. Is civil disobedience ever justified in a democratic country? When? Under what conditions?

2. Who makes energy decisions? How do average citizens have input into the process?

THE SOLAR BUILDING KIT

Kathleen Hubbard

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I have always said that students learn best by "doing". When completing the study of solar energy and its uses, I thought it would be useful for students to build and experiment with some basic structures using the solar concept that were studied in class.

Enclosed are some simple plans for 3 solar structures. The pattern pieces can be enlarged by using meter or yard sticks, or by the use of an opaque projector which can be found in most schools and libraries.

Suggested materials for the structures would be cardboard, tagboard, or styrofoam. For the solar collectors I would suggest using saran-wrap, glass, plastic, or plexiglass. Thermometers will be needed for recording temperatures in the solar structures.

I have listed some sample activities on a sheet following the plans for the structures. With a minimum amount of instructor preparation students should be able to gain some valuable insight into solar usage by practical experience.

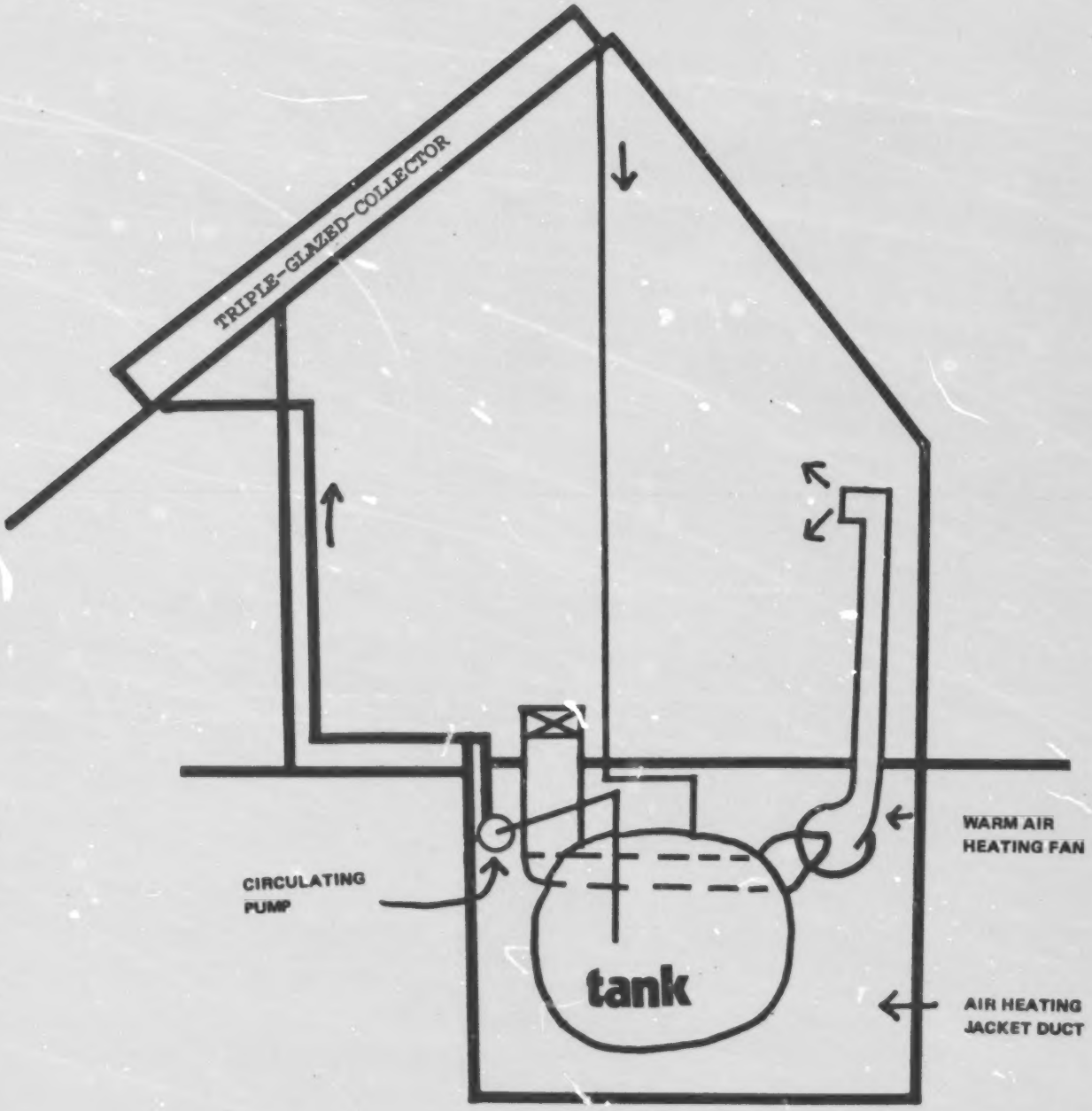
There are an abundance of activities which would correlate with the 3 solar structures inclosed in the solar building kit. From these activities the students should:

1. gain knowledge in measurement skills while building the structures
2. learn to record acurate information
3. learn how to chart information
4. gain skills in interpersonal relations by working in small groups
5. gain experience and confidence in constructing a structure
6. become more aware of the effectiveness of solar energy.

ACTIVITIES

1) In small groups have the students construct one or all of the structures in the kit. Be sure the students cut out a space for the solar collector.
2) Have the students compare the effectiveness of the various structures by placing a thermometer inside the structures and placing them outside in the sun. (face them all in the same direction)
3) Have the students take 4 of the same structure and using the same materials for the collectors place them (with a thermometer inside) facing 4 different directions. Record the temperature of all 4 houses after 30 min. wait one half an hour and record the temperatures again. Chart the information.
4) Have the students build a solar village using their structures and others they may want to build.
5) Students may devise various charts by recording temperatures of their structures using the various suggested materials for solar collectors.
6) On a large sheet of paper the teacher may place a river, desert, island, etc. with magic marker and have the students (in small groups) develop a solar community.

SOLAR STRUCTURE #1



Roof Back (cut 1)

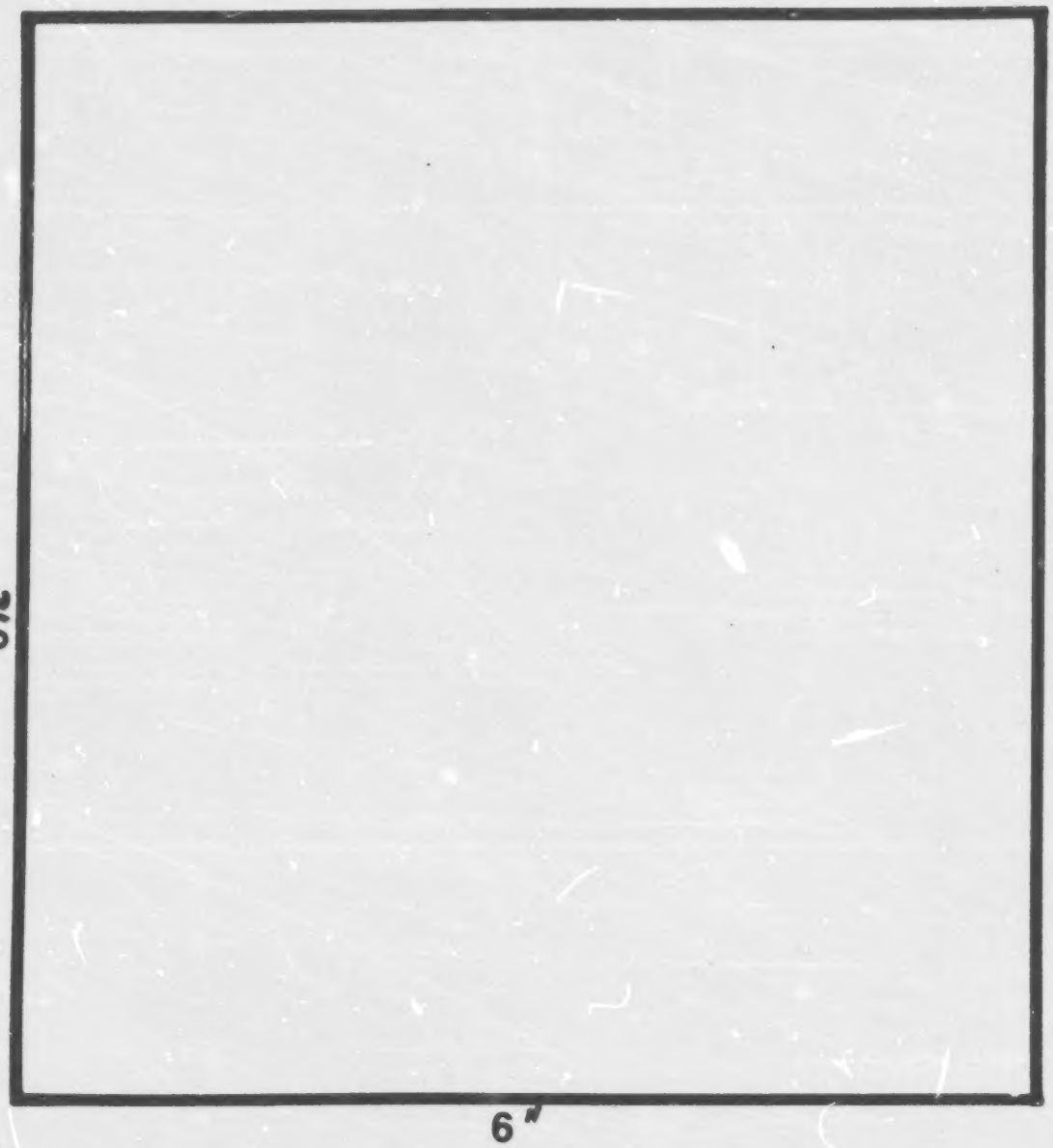
5 1/2"

6 1/2"

solar structure #1

Front

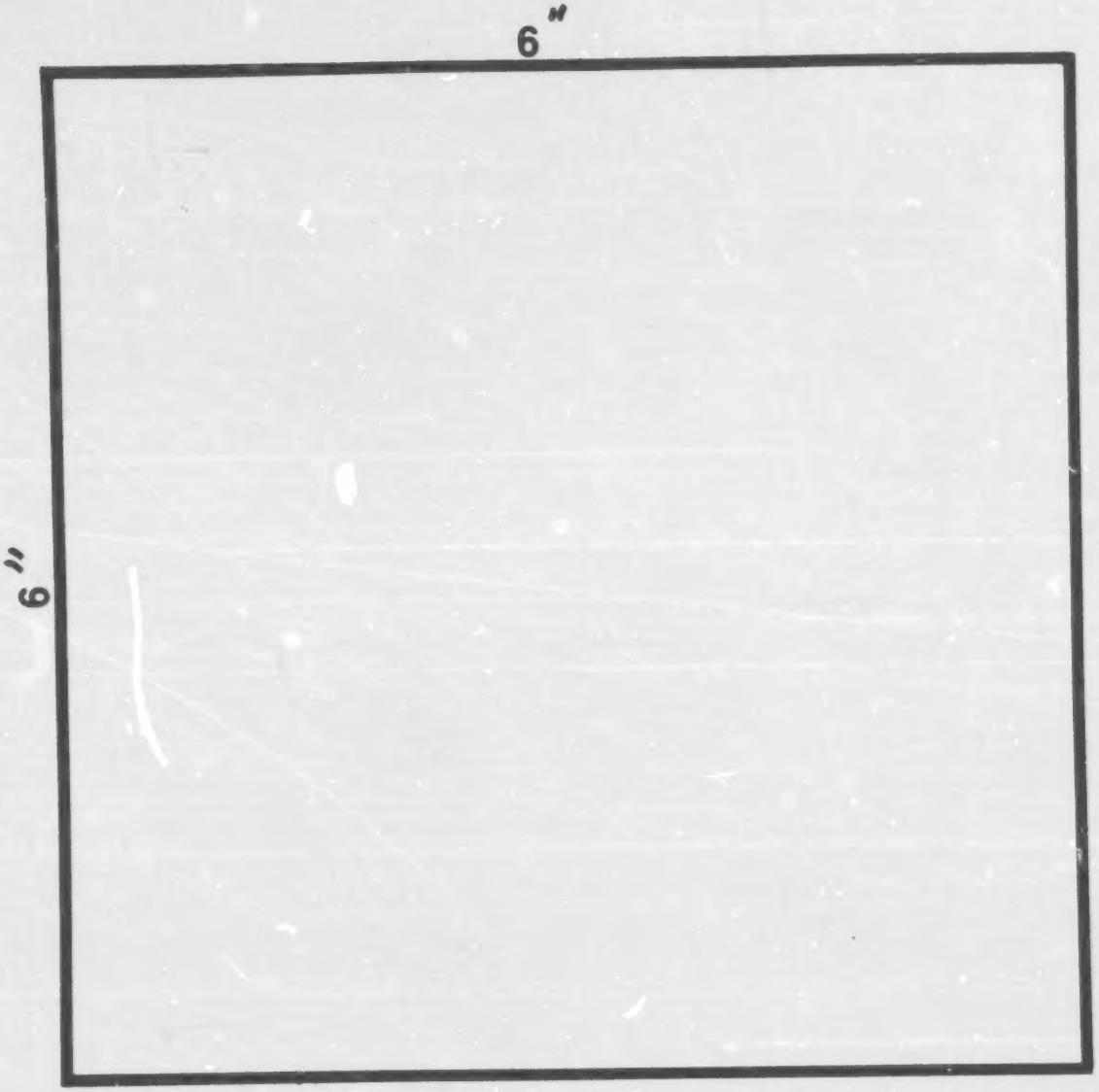
(Cut 1)



Solar Structure 1

Base-Optional

(cut 1)

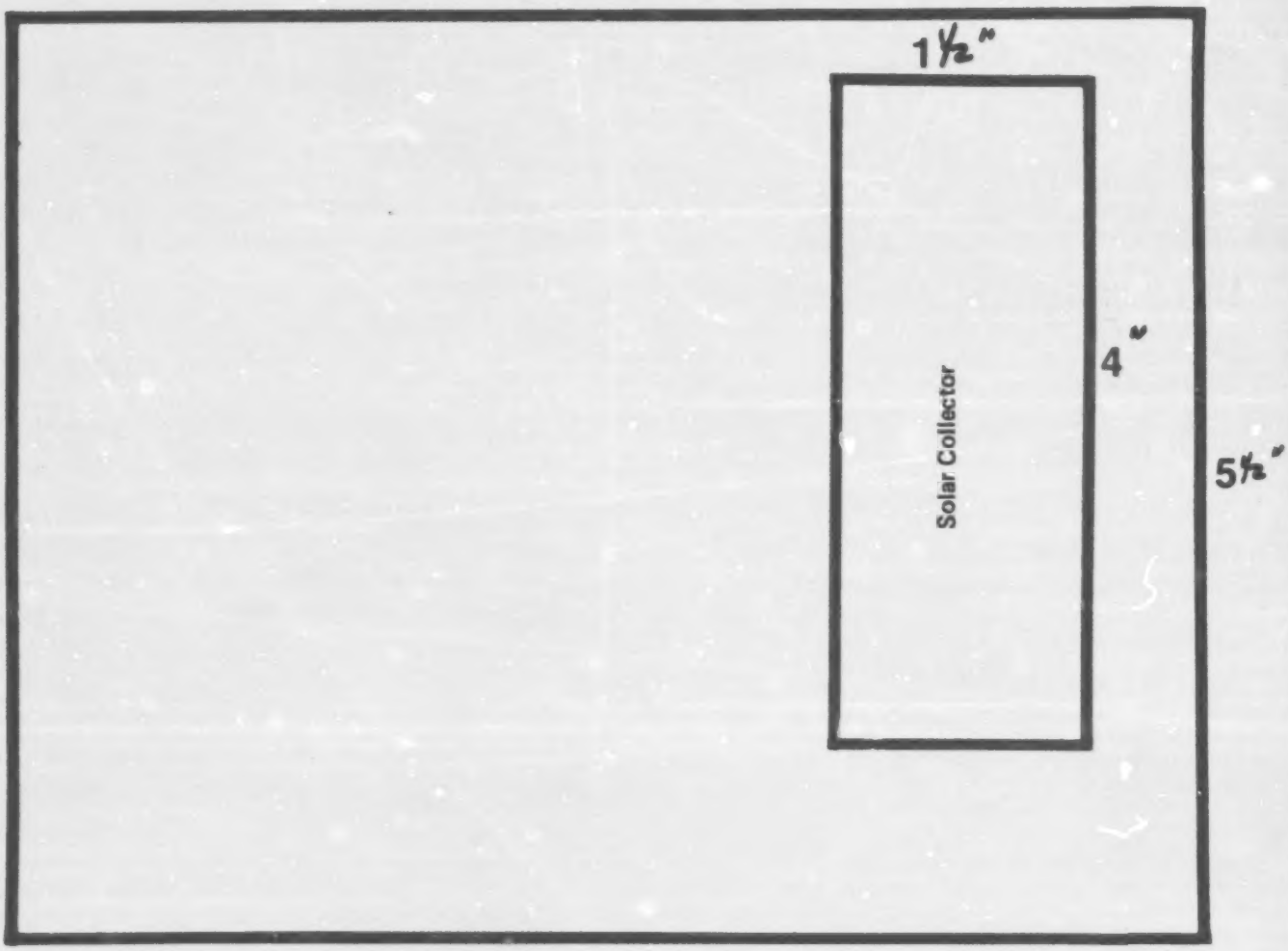


Solar Structure 1

88

Roof Front

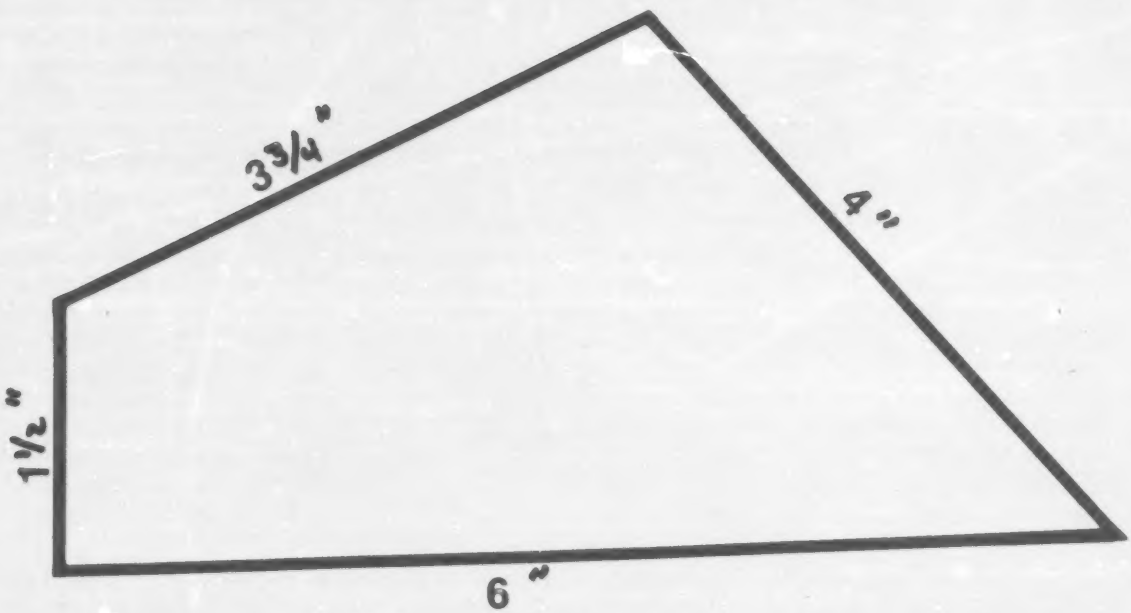
(cut 1)



Solar Structure I

Roof Sides

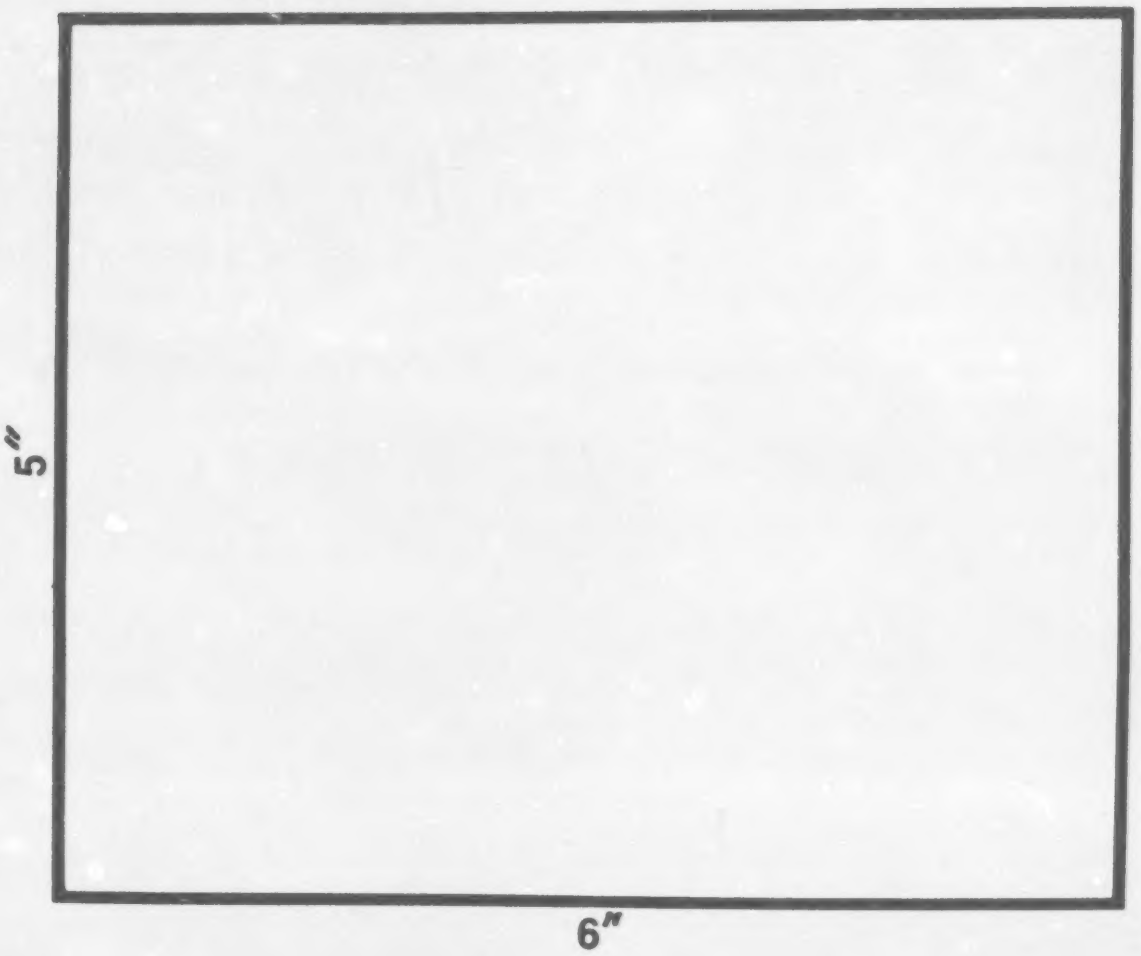
(cut 2)



Solar Structure 1

Solar Structure #1

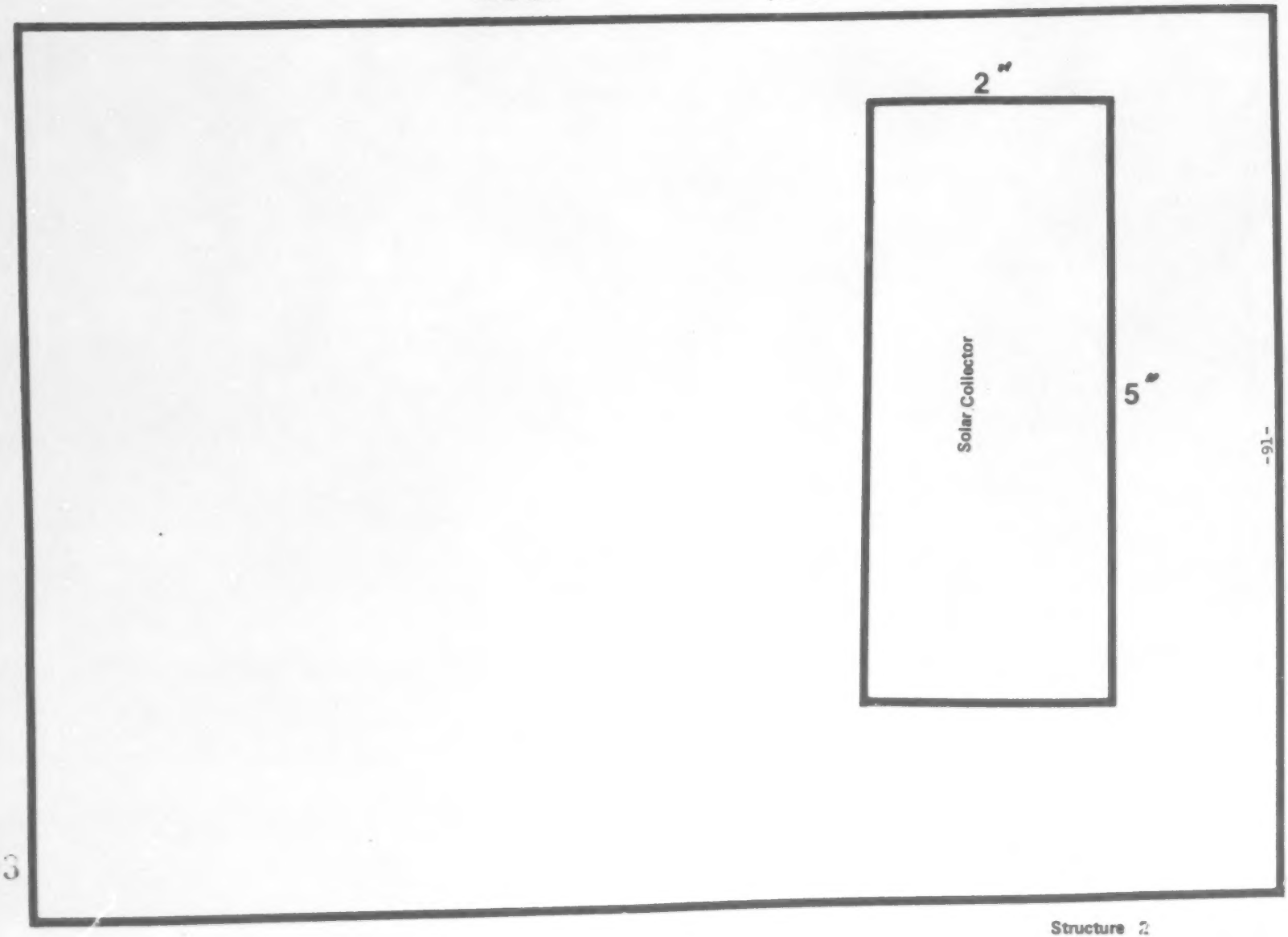
Side (cut 3)



Solar Structure
#2

Roof

(cut 1)



93

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Structure 2

Front (cut 1)

-92-

Structure # 2

BACK (cut 1)

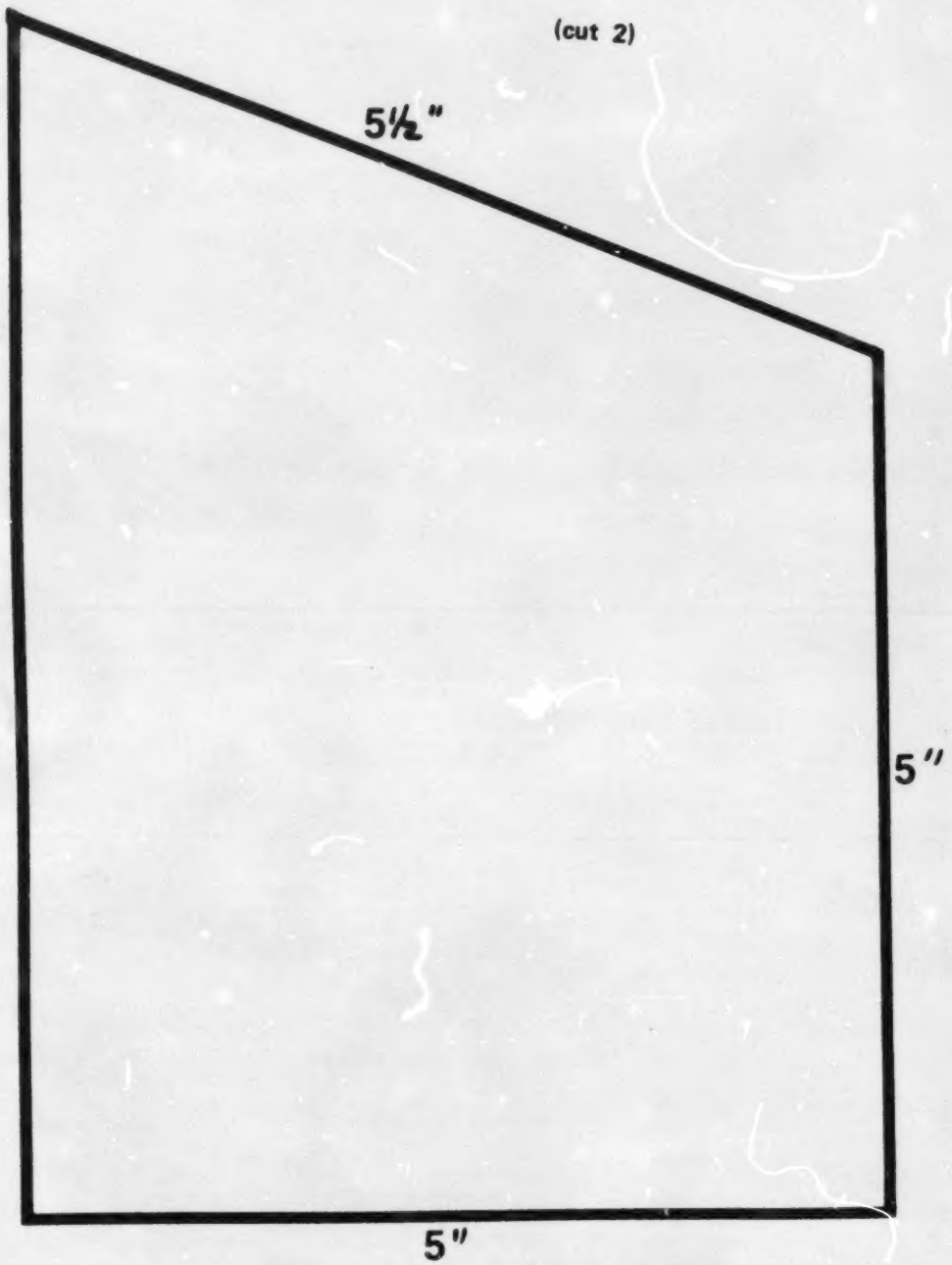
10"

5"

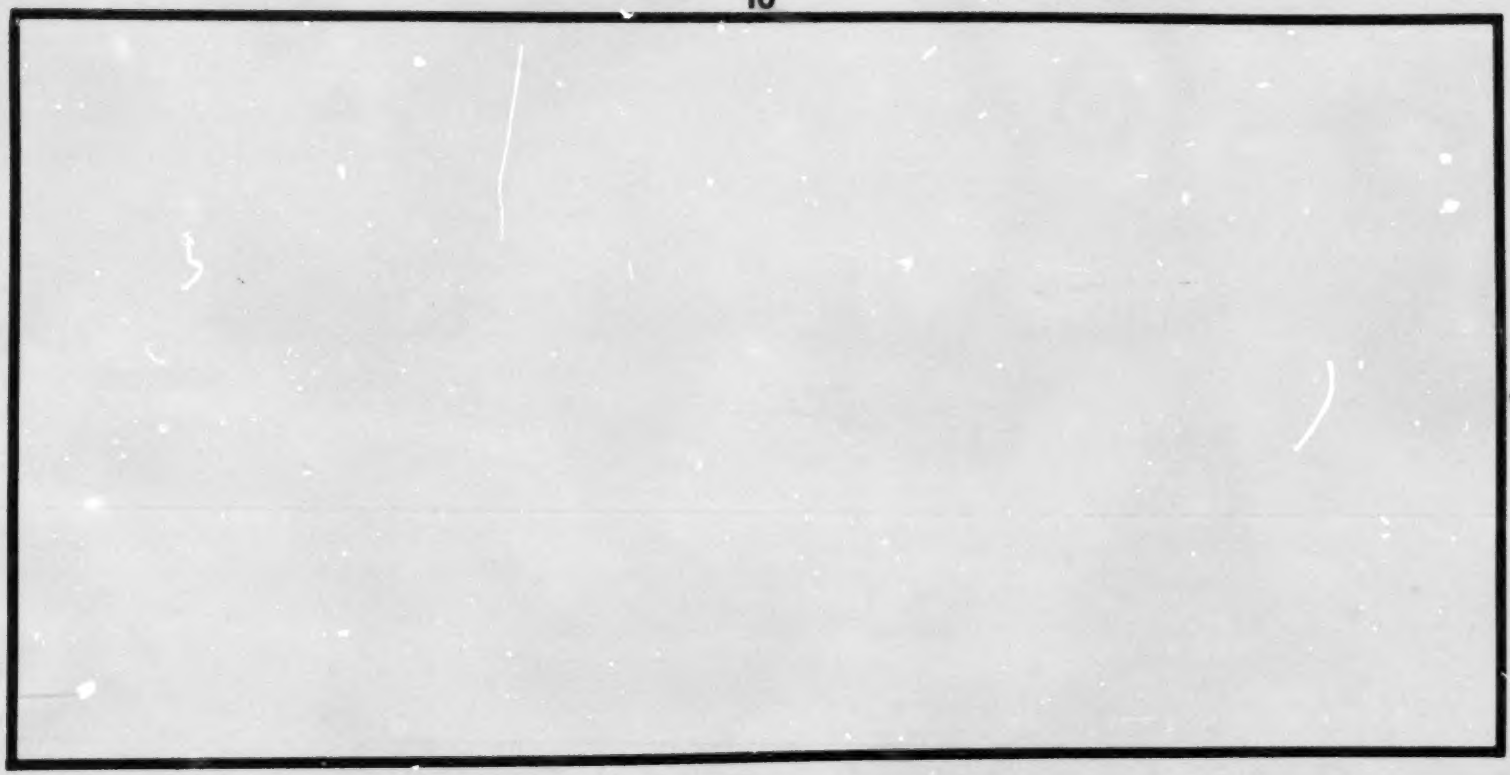
solar structure
#2

Side

(cut 2)



Base-Optional



100

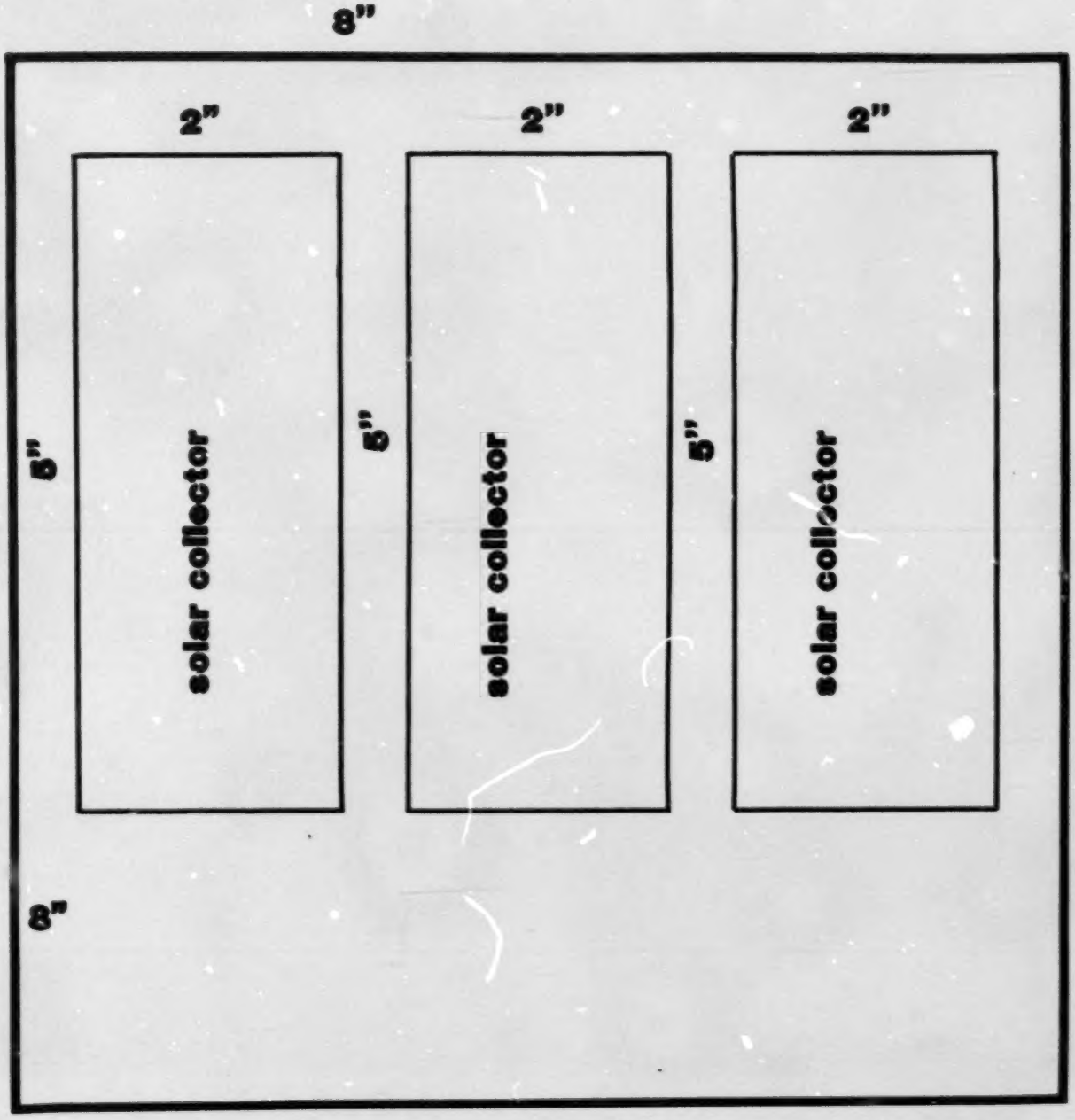
101

Structure 2

Solar Structure

#3

Roof (cut 1)



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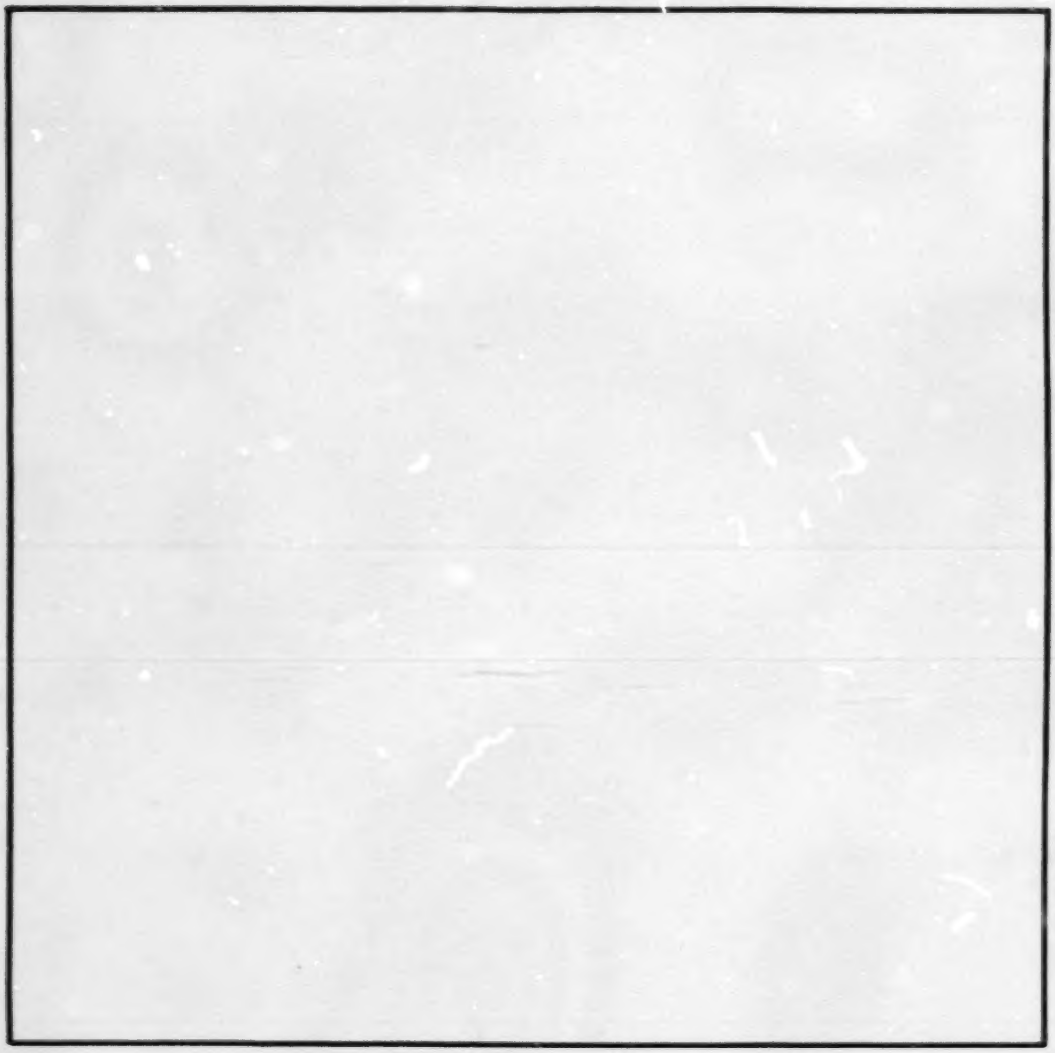
structure #3

Base (optional)

(cut 1)



7"

7"

solar sturcture #3

SIDE (cut 4)

5"

7"

solar structure#3

COURSE_____ PERIOD_____ DATE____ NAME_____

Concept: Solar-Power Densities

What is It All About?

The solar power which falls upon the earth is an immense 177 trillion KW (1.77×10^{14} KW) Which is 500,000 times the electric power capacity of the U.S. Therefore the available energy from the sun is far in excess of our foreseeable future needs. But can we find a way to harness this energy?

Styles Of Roofs

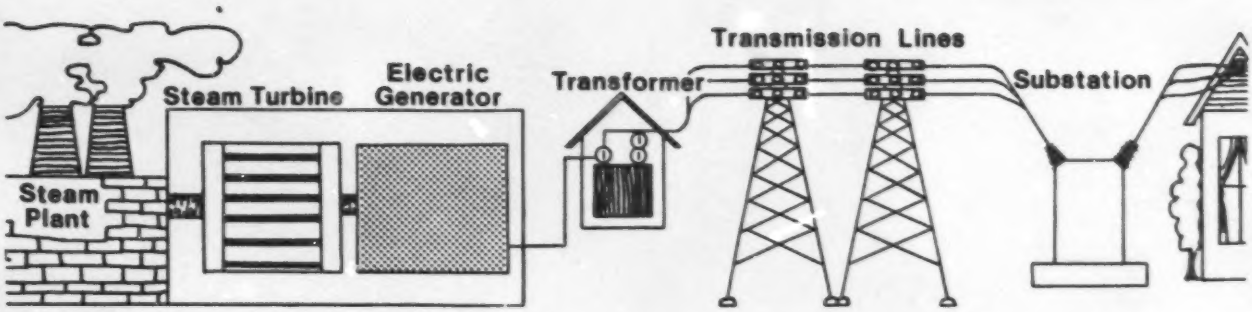
Certain well known architectural styles are best indentified by looking at the roof of the building. Several basic designs in Tallahassee will be discussed in this reading.

1. The Flat Roof is the least expensive and easiest to construct.
2. The Shed Roof is like a flat roof, that has been raised on one side. It slopes in only one direction. The style of roof is often used along with other roof designs.
3. The Gable Roof has two sloping surfaces, one on each side of the center line of the building.
4. The Hip Roof has four surfaces which all slope upward toward the center of the building. If the building is square, the four surfaces meet at a point in the center.

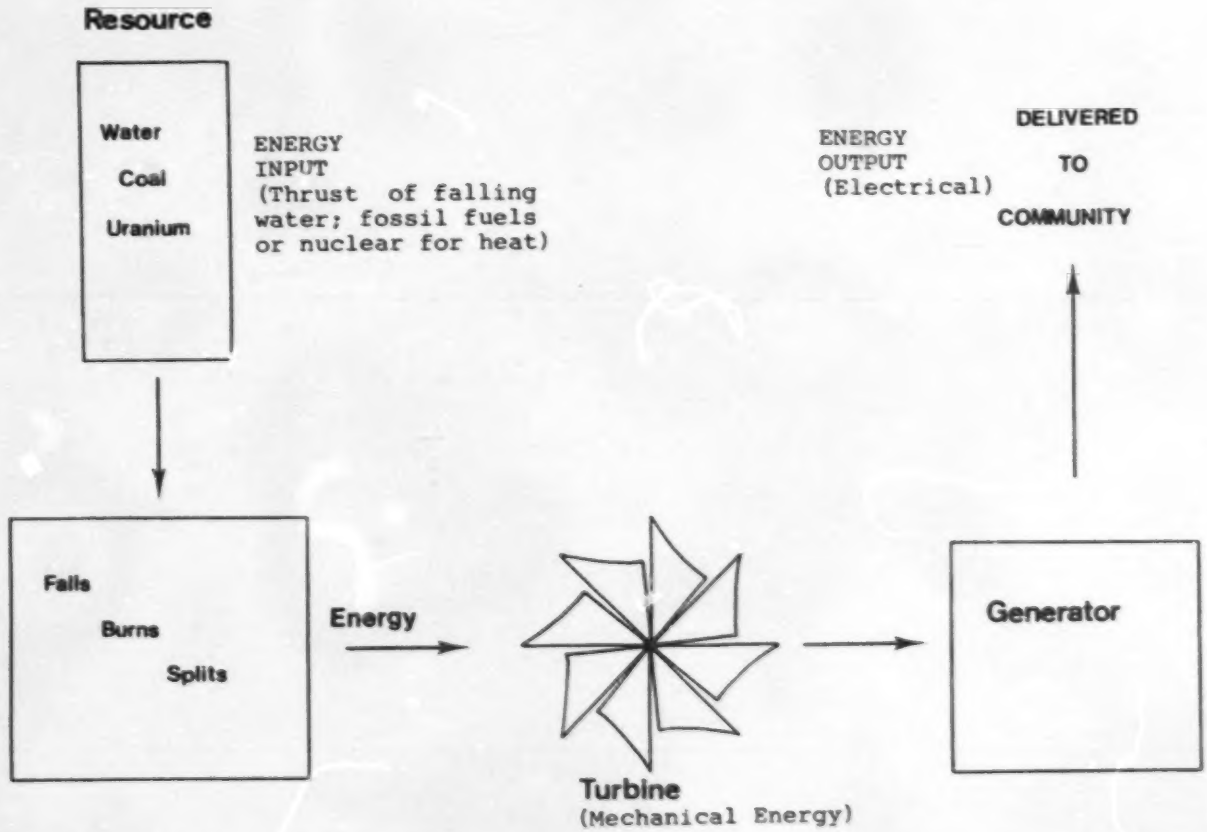
What is the design of the roof on the house you live?

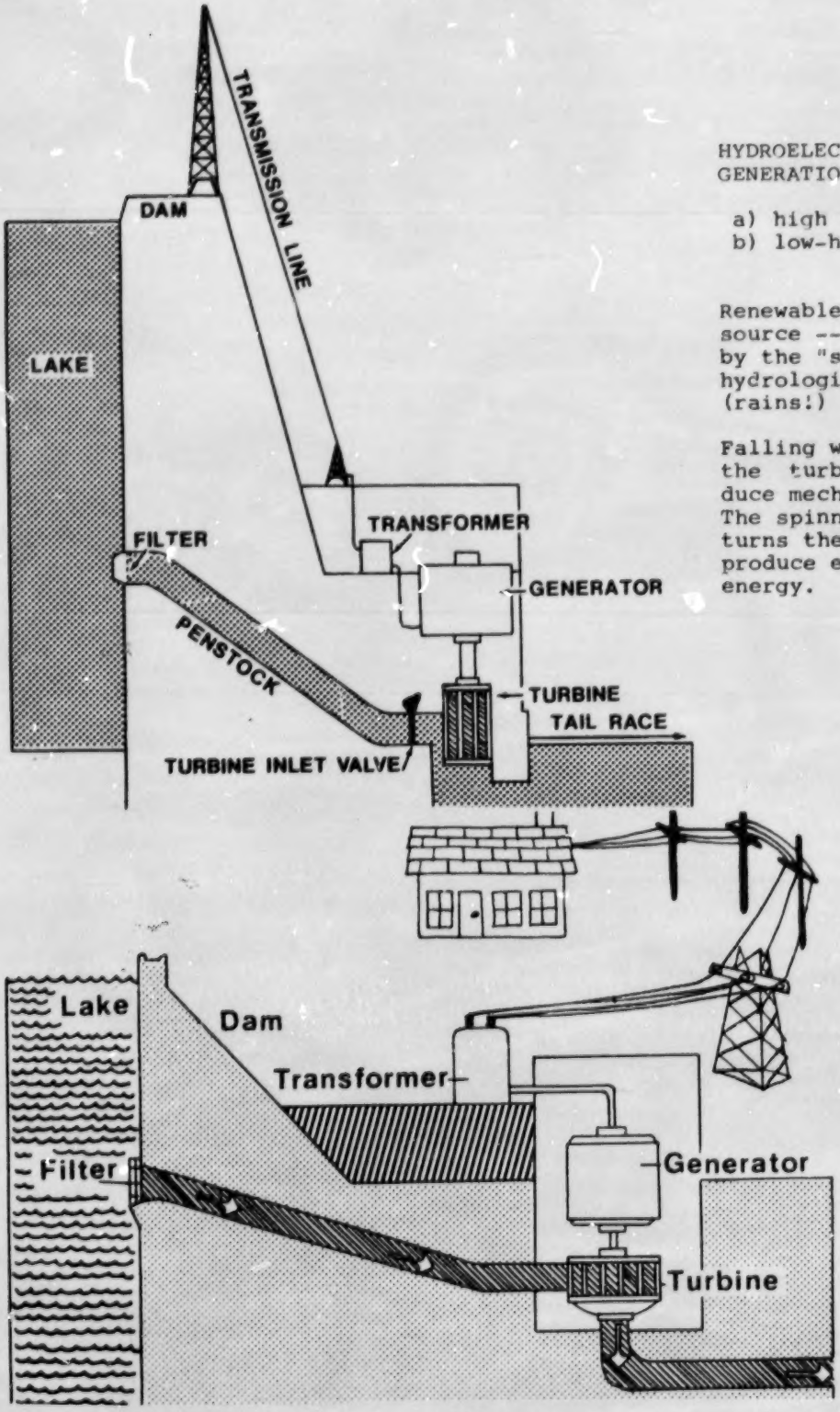
Measure and calculate the area of the roof on your home in ft.
(If you live in an apartment or condominium measure and calculate the area of buildings roof.)

Show a summary of your calculations below.



PART VII : GENERATING ELECTRICITY





HYDROELECTRIC GENERATION:

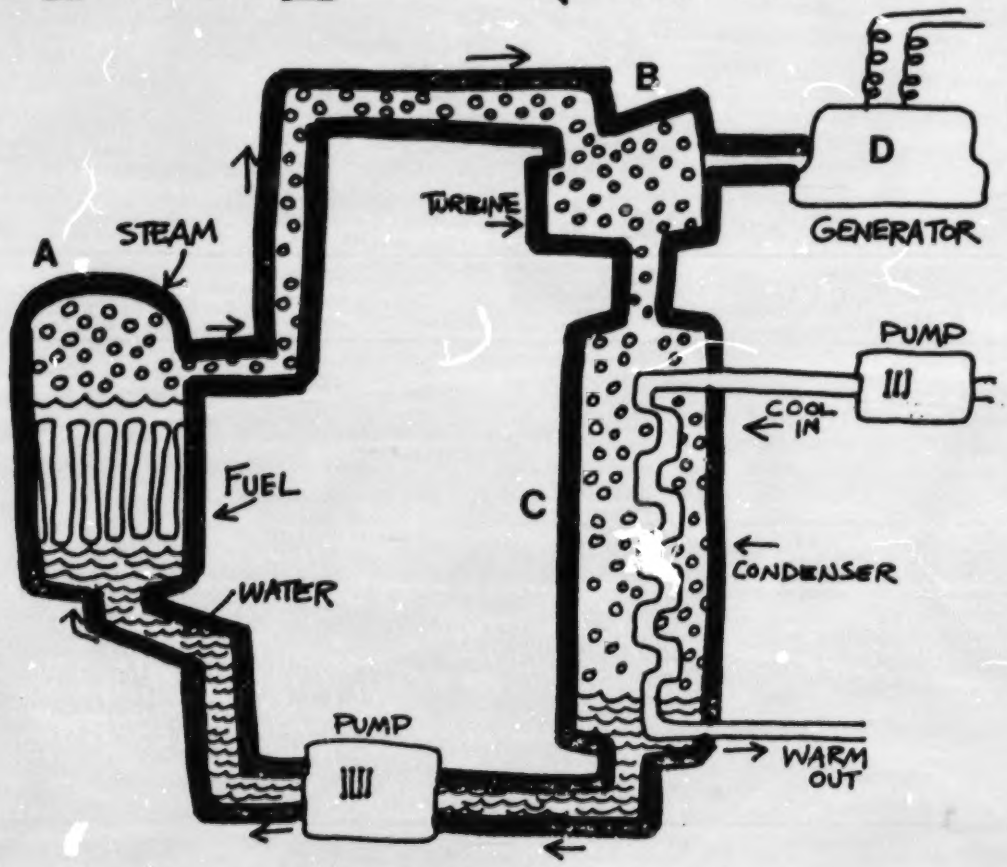
a) high dams
b) low-head dams

Renewable energy source -- renewed by the "solar-powered" hydrological cycle (rains!)

Falling water strikes the turbine to produce mechanical energy. The spinning turbine turns the generator to produce electrical energy.

The nuclear reactor produces electricity. Take your finger and trace the steps in the nuclear production of electricity, starting with the reactor (A) and ending with the generator (D). Then answer the questions below.

BOILING WATER REACTOR (BWR)

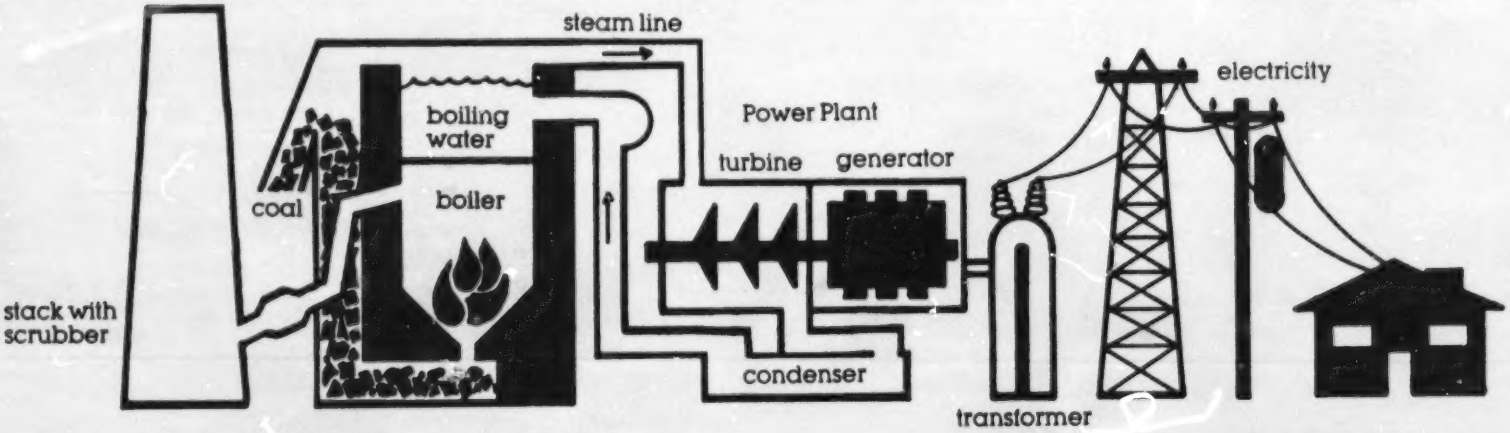


A, B, C, or D?

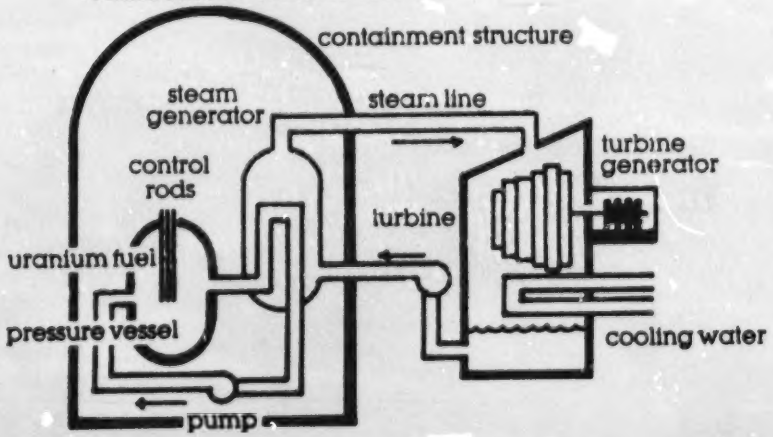
1. Where is the water changed to steam?
2. Where is the steam changed back to water?
3. Where is steam converted to mechanical work?
4. Where is the electricity made?

Electricity Production

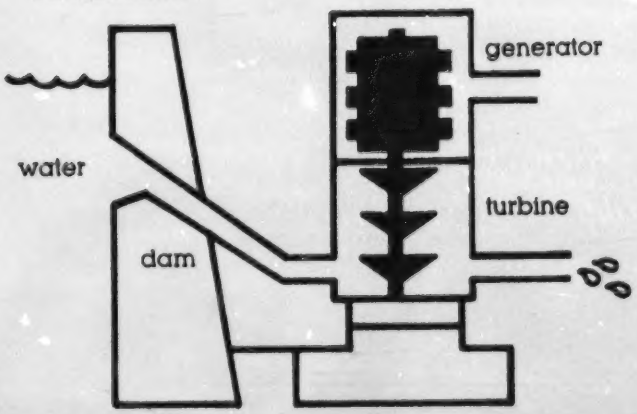
FOSSIL FUEL (COAL)
POWER PLANT



NUCLEAR POWER PLANT—
PRESSURIZED WATER REACTOR



HYDROELECTRIC
POWER PLANT



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THE CITY OF TALLAHASSEE UTILITIES DEPARTMENT

The City produces electricity at two locations: St. Marks and the Hopkins plant, west of Tallahassee.

The St. Marks plant, south of Tallahassee, has 9 generating units:

STEAM:	4 units	7.5 Megawatt each
	2 units	25 Megawatts each
	1 unit	50 Megawatts
GAS TURBINE:	2 units	11 Megawatts each

The Hopkins plant has 4 generating units:

STEAM:	1 unit	80 Megawatts
	1 unit	258 Megawatts
GAS TURBINE:	1 unit	15 Megawatts
	1 unit	30 Megawatts

These plants use natural gas and a low-grade petroleum product (Bunker C) to produce electricity.

For each 100 units of energy placed under a boiler (as input of energy) 10 units are lost up the stack; 50 units are lost as low-grade heat from the cooling towers; and 40 units are sent out as electricity to customers. The plants have roughly a 40% efficiency.

In this packet we have not illustrated a gas turbine. In essence, it is a jet engine which (like a water wheel) produces mechanical energy to spin an electrical generator. You will experience this on your tour of a Tallahassee power generating plant.